COMMERCIAL FERTILIZER

CONSOLIDATED WITH THE FERTILIZER GREEN BOOK

WHAT ARE 2-A ? 3 ? 4 ? 6 ?

2-A, 3, 4, and **6** are designating numbers for four different Barrett Standard Nitrogen Solutions. Solution 2-A contains 11.36% nitrate nitrogen and 29.24% ammonia nitrogen. Solution 3 contains 9.62% nitrate nitrogen and 31.18% ammonia nitrogen. Solution 4 contains 11.65% nitrate nitrogen and 25.35% ammonia nitrogen. Solution 6 contains 10.5% nitrate nitrogen and 38.5% ammonia nitrogen.

All of these Solutions are economical sources of nitrogen and serve as excellent curing media to quickly condition superphosphate mixtures to granular, free-running fertilizers.

For many years, Barrett's continuing research has constantly worked to improve both the quality of Solutions and the technology of their use in formulating better fertilizers. If you have a question on Solutions, *ask Barrett!*

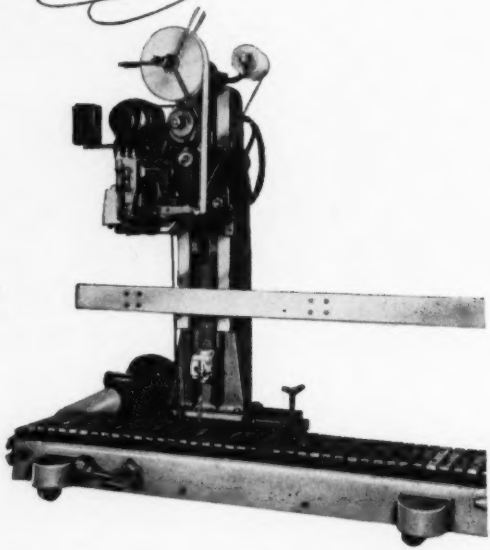
THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET, NEW YORK 6, N. Y.
RICHMOND 19, VA. • SOUTH POINT, OHIO • HOPEWELL, VA.
COLUMBIA 1, S.C. • ATLANTA 3, GA. • SAN FRANCISCO 3, CAL.

Barrett* NITROGEN

The element that makes plants grow!

*Reg. U. S. Pat. Off.

THE BAG CLOSER WITH THE "built-in Guardian Angel"



Model ET applies famous "Cushion-Stitch" over dry tape for sift-proof closure. Model E-1 applies "Cushion-Stitch" only, for use where sift-proofing is not essential.

When you buy a Bagpaker®, you get a "guardian angel" as well.

He may not look as angelic as the cherubs on a Christmas Card, but his intentions are just as golden. He's the Bagpak Service Engineer, and his job is to keep your Bagpaker in good shape—happy and well-adjusted so that it can provide the kind of continuous, trouble-free performance it was built to give.

That isn't very hard for a Bagpaker to do, because Bagpak designers have put in *extra strength*—heavy duty working parts—welded steel construction—all improvements that reduce lost time due to breakdowns. The savings on this alone can be tremendous over the years.

The combination of superior design and construction, plus experienced Bagpak service, makes the Bagpaker the kind of machine that brings your bag closing operation "a little closer to heaven."

For full details, write today and ask for booklet 255 C

BRANCH OFFICES: Atlanta • Baltimore • Baxter Springs, Kansas • Boston • Chicago • Cleveland • Denver • Los Angeles • New Orleans • Philadelphia • Pittsburgh • St. Louis • San Francisco.
IN CANADA: The Continental Paper Products, Ltd., Montreal, Ottawa.

IT'S LION FOR ONE STOP Nitrogen Service FOR FERTILIZER MANUFACTURERS

Lion Anhydrous Ammonia — Manufactured in Lion's modern plant to an 82.25% nitrogen content under accurate chemical control, the uniformity and high quality of this basic product are assured.

Lion Aqua Ammonia — This product is available to manufacturers for use in the formulation of mixed fertilizers or for sale as direct application material. Normally about 30% ammonia, its content can be controlled by order to suit your needs.

Lion Nitrogen Fertilizer Solutions — Made specifically for the manufacturing of mixed fertilizers, these products supply both ammonia nitrogen and nitrate nitrogen in the ratios desired. They are easily handled and available in three types designed for varying weather conditions, and for formula requirements in the production of fertilizers that cure rapidly, store well and drill evenly.

Lion Ammonium Nitrate Fertilizer — The improved spherical white pellets in this product contain a guaranteed minimum of 33.5% nitrogen. They flow freely, resist caking and store much better. Lion Ammonium Nitrate Fertilizer is shipped in 100-pound, 6-ply bags with two moisture-proof asphalt layers.

Lion Sulphate of Ammonia — This new, superior-type sulphate is guaranteed to contain a minimum of 21% nitrogen. Through special conditioning of the larger crystals, moisture and free acid content is greatly reduced. These factors, together with the special coating applied, make for greater resistance to caking in shipment or in storage. This product flows freely. It is shipped in bulk and in 100-pound, 6-ply bags laminated with asphalt.

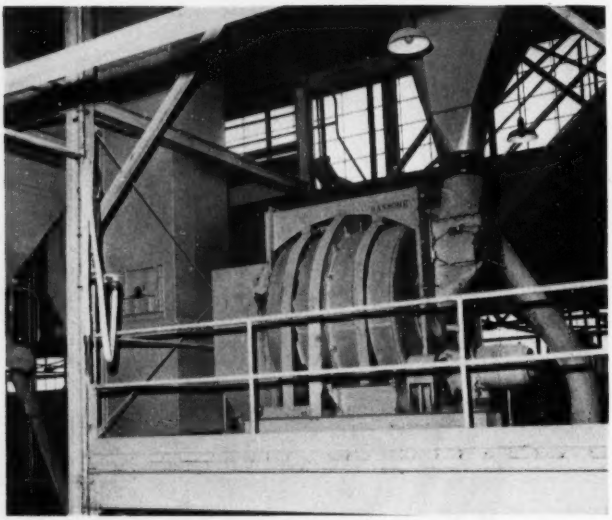
"Serving Southern States"

LION

Technical advice and assistance to fertilizer manufacturers in solving their manufacturing problems is available for the asking. Just write.

LION OIL COMPANY CHEMICAL DIVISION EL DORADO, ARKANSAS

Keeps Production Steady



Big fertilizer company prefers dust-proof, fume-proof, simple construction of

WORTHINGTON *Ransome* MIXER

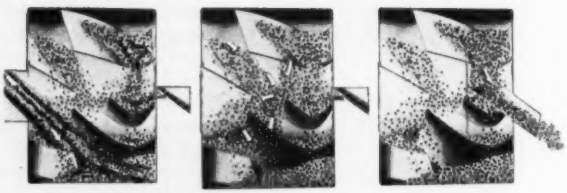
Dust can't interfere with efficiency and profits with this big fertilizer mixer on the job.

Construction is dust-proof, fume-proof.

Other features: air-operated control for charging and discharging (valve operated by hand or by solenoid and remote push-button) . . . automatic vibrating hammers to prevent "building up" inside drum . . . large clean-out manholes.

Standard sizes—½, 1, 2 tons. Pulley or direct electric motor drive with fully-enclosed, fan-cooled motor.

Write for bulletin on Worthington-Ransome Mixers, built from designs developed from nearly a century of mixer experience. And remember *other* Worthington products for the fertilizer industry—acid pumps, air compressors, air spades, etc. *Worthington Pump and Machinery Corporation, Ransome Industrial Mixer Division, Dunellen, New Jersey.*



THIS IS THE FAMOUS RANSOME MIXING ACTION

1. As charge enters, it is scattered over the bottom. (Drum revolves toward you in picture.)

2. Mixture then goes up sides, falls in two fanlike formations, is carried up again—operation repeated.

3. When mixed, material is discharged, leaving drum completely clean of all, including finest, material.

WORTHINGTON

YR.1.3

1000 pounds of 8-8-8 on corn means an extra
44 bushels per acre for Robert A. Jones, Urbana, Ohio
Mr. Jones reports a yield of 113 bushels per acre with 300 pounds of 3-12-12 applied in the row. But when he plowed under 1000 pounds of 8-8-8 in addition to the row fertilizer, yield rose to 157 bushels per acre. "... the addition of 1000 pounds of 8-8-8 fertilizer plowed down is good for an increase of at least 40 bushels per acre," he says. "Corn is planted a little thicker to cash in on the larger fertilizer application."
Plow Under 1000# 8-8-8
Row - 300# 3-12-12
Plants Per Acre - 25,800
Yield Per Acre 157 Bu.
USS
AMMONIUM SULPHATE
UNITED STATES STEEL

Bigger yields for farmers ... better business for you

● Here's another success story with high-analysis complete fertilizer.

More and more farmers are becoming convinced that extra nitrogen pays off handsomely in increased yields and increased profits. To get your full share of this growing business, be sure your line includes high-grade complete fertilizers containing U·S·S Ammonium Sulphate.

Dry, free-running U·S·S Ammonium Sulphate stands up well in storage . . . doesn't corrode drills or other distributing equipment. It won't leach out of clay loam or sandy soils during rains, yet converts to readily available form during the warm, moist growing season.

Plan your needs of U·S·S Ammonium Sulphate well in advance of mixing time . . . supplies are somewhat shorter this year. United States Steel Company, 525 William Penn Place, Pittsburgh 30, Pa.

USS

U·S·S AMMONIUM SULPHATE

UNITED STATES STEEL

COMMERCIAL FERTILIZER

ESTABLISHED 1910

June, 1951

Vol. 82, No. 6

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Chicago Representative
ELON A. ABERNETHY
1323 S. Michigan Ave.—Room 400
Phone Harrison 7-3655

West Coast Representative
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2267 W. 24th St., Los Angeles, Cal.
Phone REPUBLIC 1-3050

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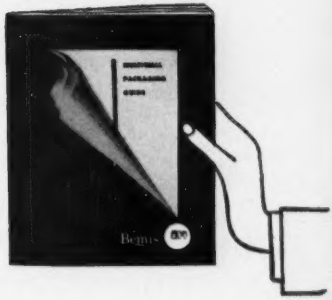

GET YOUR COPY OF

. . . it shows how to do a more efficient packaging and handling job and save materials and labor. Deals with Storage of Empty Bags, Filling and Closing, Handling of Filled Bags, Palletizing and other important topics. Ask your Bemis Man or write to the nearest Bemis office. No cost to you, of course.

BEMIS BRO. BAG COMPANY

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Baltimore · Boise · Boston · Brooklyn · Buffalo · Charlotte · Chicago · Cleveland · Denver · Detroit · Jacksonville, Fla.
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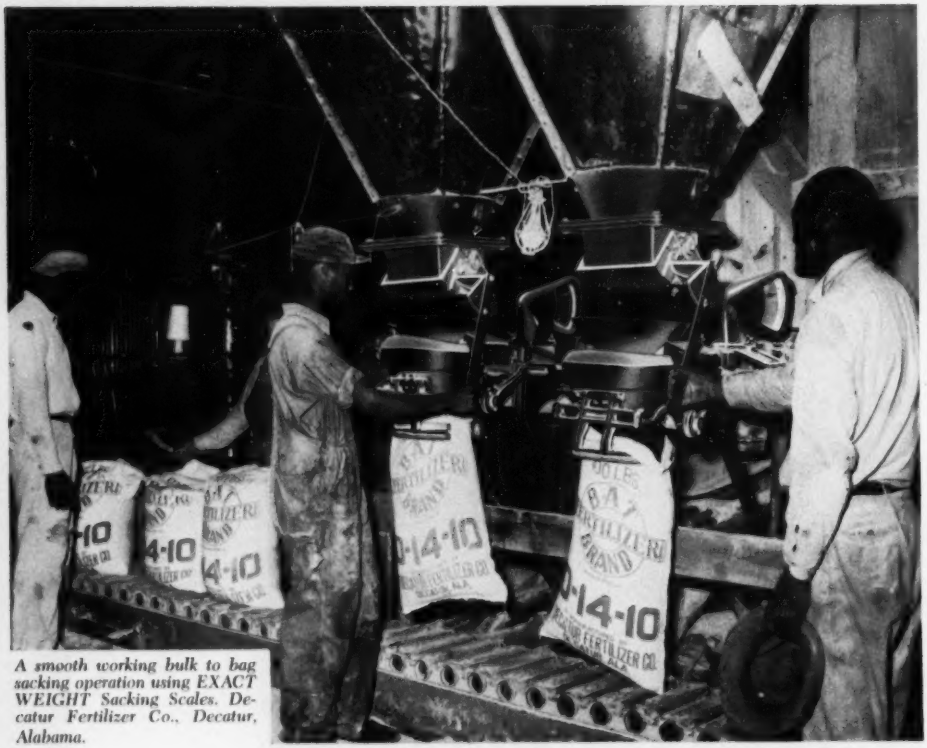

A smooth working bulk to bag sacking operation using EXACT WEIGHT Sacking Scales. Decatur Fertilizer Co., Decatur, Alabama.

For Results Getting Fertilizer Packaging . . .

The fertilizer industry like other American industries has reached its present efficiency by virtue of the machine . . . the right equipment for the right jobs. This has speeded up production generally, increased volume, trimmed costs. From the first operation, ingredient mixing to the last operation, packaging the fertilizer industry has kept the pace. EXACT WEIGHT Sacking Scales are today and have been for years, an important factor in low cost result getting sacking. The sack, weigh and check feature of 5 to 8 bags per minute has been in use many years. With adequate conveyor be't installations there is no lifting, double handling or extra checkweighing all of which slows production . . . adds to present day high labor costs . . . cuts profits. If you want to improve your packaging you will get results by installing new EXACT WEIGHT Sacking Scales throughout. Write for full details.

SALES and SERVICE
in all Principal Cities
from Coast to Coast
and Canada.

EXACT WEIGHT SCALES
Industrial Precision
THE EXACT WEIGHT SCALE COMPANY

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POTASH
TRONA
SALTS

Trona
Muriate of Potash

This vitally important ingredient of mixed fertilizer provides the soil nutrient necessary to resist plant diseases and to enhance the productivity of crops. To obtain the best results, specify "Trona" Muriate of Potash . . . made by the pioneer producers in America.

Three Elephant
Agricultural Pentahydrate
Borax

Contains a minimum of 44% B_2O_3 or approximately 121% equivalent Borax. More economical in this concentrated form when used as an addition to fertilizer or for direct application to the soil, to correct a deficiency of Boron. Consult your local County Agent or State Experimental Station.

AMERICAN POTASH & CHEMICAL CORPORATION

122 EAST 42nd STREET . . . . NEW YORK 17, N. Y.

231 S. LA SALLE STREET, CHICAGO 4, ILLINOIS
214 WALTON BUILDING, ATLANTA 3, GEORGIA
3030 WEST SIXTH STREET, LOS ANGELES 54, CALIF.

JUST AROUND THE CORNER

By Vernon Mount

IRAN IS THE SPOT TO WATCH or words to that effect were written here many, many months ago. I thought Russia would take that oil by force. She has taken it by guile. Even the canny British were outsmarted.

ARMIES TRAVEL ON OIL is the modern version of Napoleon's dictum about armies and their stomachs. Russia's mechanized might can be turned loose, once the oil is flowing freely toward whatever front or fronts she chooses to open.

BRAINS ARE CHEAPER THAN MUNITIONS and while Russia can outthink and outmaneuver the rest of the world, she is not going to spend the munitions. But corner a rat and he'll fight...so we cannot afford to relax and gloat over "easy" victories in Korea.

WHILE WE WRANGLE, RUSSIA MOVES -- and she moves with the inexorable quality of that irresistible force we learned about in school. The question now is, when will the free nations present a solid, immovable body?

HISTORY IS WATCHING.

Yours faithfully,

Vernon Mount

Summer on the Farm
Though the grass could use a mowin',
And the corn is needin' hoein',
And the 'tater bugs are chewin' up the vine,
It's not just a case of shirkin',
But the ones who do the workin'
Are all shoutin', "Come on in, the water's fine!"

"Come on in, the water's fine!"

. . . applies to the Fertilizer industry too, as more and more farmers are becoming fertilizer users.

Raymond Multi-Wall Paper Shipping Sacks are keeping pace with the rapidly growing Fertilizer industry. These dependable, CUSTOM BUILT Shipping Sacks, with trade names sparkling in brilliant colors, solve every packing and shipping problem for producers, packers, and shippers of fertilizer.

Raymond Shipping Sacks are made in various sizes, types, and strengths—printed or plain.

THE RAYMOND BAG COMPANY
Middletown, Ohio

RAYMOND MULTI-WALL PAPER SHIPPING SACKS

THE TREND IS TOWARD COTTON!

Many fertilizer manufacturers are discovering the advantages of packing fertilizer in smart, good-looking cotton bags—either plain sheeting or osnaburg, or the ever-popular Dainty Prints. In either case, housewives everywhere are delighted with the premium yardage offered; and dealers are pleased with the extra re-sale value of the bags.

Our plants are all located in the South within easy freight-rate distance of the cotton mills. And Mente, since 1885, has specialized in the manufacture of best-quality textile bags of all kinds. Write, wire, or phone our nearest office today.

Satisfaction Plenty When You Buy Mente!

MENTE & CO., INC.

Dept. B1

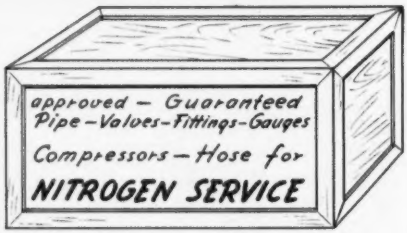
Isaac T. Rhea, Pres.

Box 1098 Savannah | Box 690 New Orleans | Box 204 Houston

Sales Offices or Representatives in New York, Chicago, Kansas City, St. Louis, Minneapolis, Denver, Cincinnati, and other large cities.

Approved Piping Equipment for NITROGEN SOLUTIONS

Handling Nitrogen Solution, even under pressure, is an easy job for pipe, valves, fittings and other accessories that are designed for this corrosive job. Aluminum piping with "quick opening" valves designed to carry Nitrogen Solution, insure a trouble-free piping system that will carry this solution from the tank-car to your storage tank, and then to your mixer. Air hose, pipe and an adequate compressor to give the pressure you need for quick, efficient operation must be free from any copper or copper alloy connections, brazing, or welding.



A piping layout using these materials, is approved by all the major producers of this chemical. These materials are available from one source. Ask your Solution Representative, and write for free bulletin showing a detailed piping layout and complete "bill of materials".

J. M. TULL METAL & SUPPLY CO., Inc.

285 Marietta Street N.W.

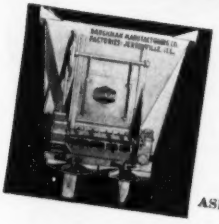
Atlanta 3, Georgia

For the complete line of spreader bodies, look to Baughman, because

Baughman BUILDS 'EM ALL !

ASK-3-8

ASK-3W-6

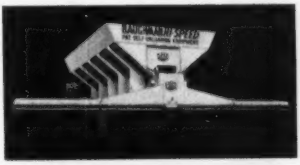


ASK-MS-4

- 13 basic agricultural models . . . one or more is engineered and built to fit your specific needs.
- Lengths from 9 to 33 ft. (5 to 30 tons capacity) . . . 1 to 6 compartments for selective unloading.
- Available with single or double distributor.
- Available in 4 different gear reductions and flight spacing as desired to control volume from a few hundred lbs. per acre to 3 or more tons per acre.
- Complete selection of bottom widths, top widths and degrees of side slope.
- Built of high tensile alloy steel to assure maximum payload.
- Baughman's NEW Oil Sealed Clutch and 3 Speed Transmission regulate rate of discharge from body. Velocity of spinner remains in constant ratio to engine speed due to new direct type drive — permits wide, even spread at all times.

Write for full information and our recommendations. More than 25,000 Baughman Self-Unloading Bodies from coast to coast.

Model O-2 Spreader Attachment — Gives uniform spread on the level, slopes or hillsides. Folds securely for highway travel. Ideal for rock phosphate, dry powdered lime and many other materials.

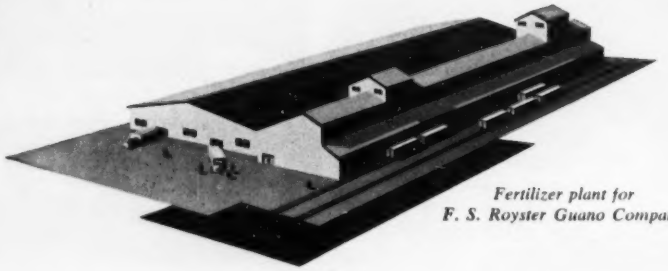


Model 235 Fertilizer Sprayer. Holds the material to the ground and makes it stick. Covers as high as 4 acres to the mile at 15 miles per hour. High tensile alloy steel construction. Rubber and canvas curtains prevent blowing.

Usually Delivered from Stock

BAUGHMAN MANUFACTURING CO., Inc.
961 SHIPMAN ROAD JERSEYVILLE, ILLINOIS

"The Pioneers of the Fertilizer Spreading Industry"



Fertilizer plant for
F. S. Royster Guano Company

You Get Modern Flexible Design At Low Cost With McCloskey Buildings

Your operations may call for a building of eccentric design or a simple structure—both can be built to suit your requirements with economy by McCloskey. All stresses and loads are carefully calculated to give you a substantial permanent building, tailor-made for you in any width—any length.

Complete construction service is furnished by McCloskey. Our engineers give you the benefit of their long experience in building industrial plants. They supervise construction from start to finish. Your staff can continue its regular duties without devoting productive time to your building project.

You will be pleased like many of the largest companies around the world with your McCloskey Buildings. They have found that the complete construction services save them time and money. The modern flexible design also saves on initial investment and future maintenance.

Call on McCloskey before you plan your new building or plant. Learn how you can get the best buildings and at the same time save money. Write McCloskey Company of Pittsburgh, 3412 Liberty Avenue, Pittsburgh 1, Pa.

McCloskey Company
of Pittsburgh

You Can Depend on Phillips For Nitrogen!

AMMONIUM SULFATE

Phillips *66* Ammonium Sulfate is a free-flowing 21% nitrogen material! Mixes easily! Uniform crystals resist caking! Ideal for high analysis mixed goods! A fine direct application material, too!

AMMONIUM NITRATE

Phillips *66* Prilled Ammonium Nitrate contains 33% nitrogen. The small, coated prills or pellets resist caking . . . handle easily. Depend on Phillips *66* Prilled Ammonium Nitrate for uniform, free-flowing properties and top-notch crop response.

NITROGEN SOLUTIONS

Get more N per dollar! Phillips *66* Nitrogen Solutions are well suited to the preparation of high-analysis fertilizers and the ammoniation of superphosphate. These three nitrogen solutions keep handling costs low! Promote rapid, thorough curing!

ANHYDROUS AMMONIA

Tank car shipments of Anhydrous Ammonia (82% nitrogen) are assured to Phillips contract customers by Phillips huge production facilities in the Texas Panhandle. Write our nearest district office for full information.

PHILLIPS CHEMICAL COMPANY

A Subsidiary of Phillips Petroleum Company

FERTILIZER SALES DIVISION • BARTLESVILLE, OKLAHOMA

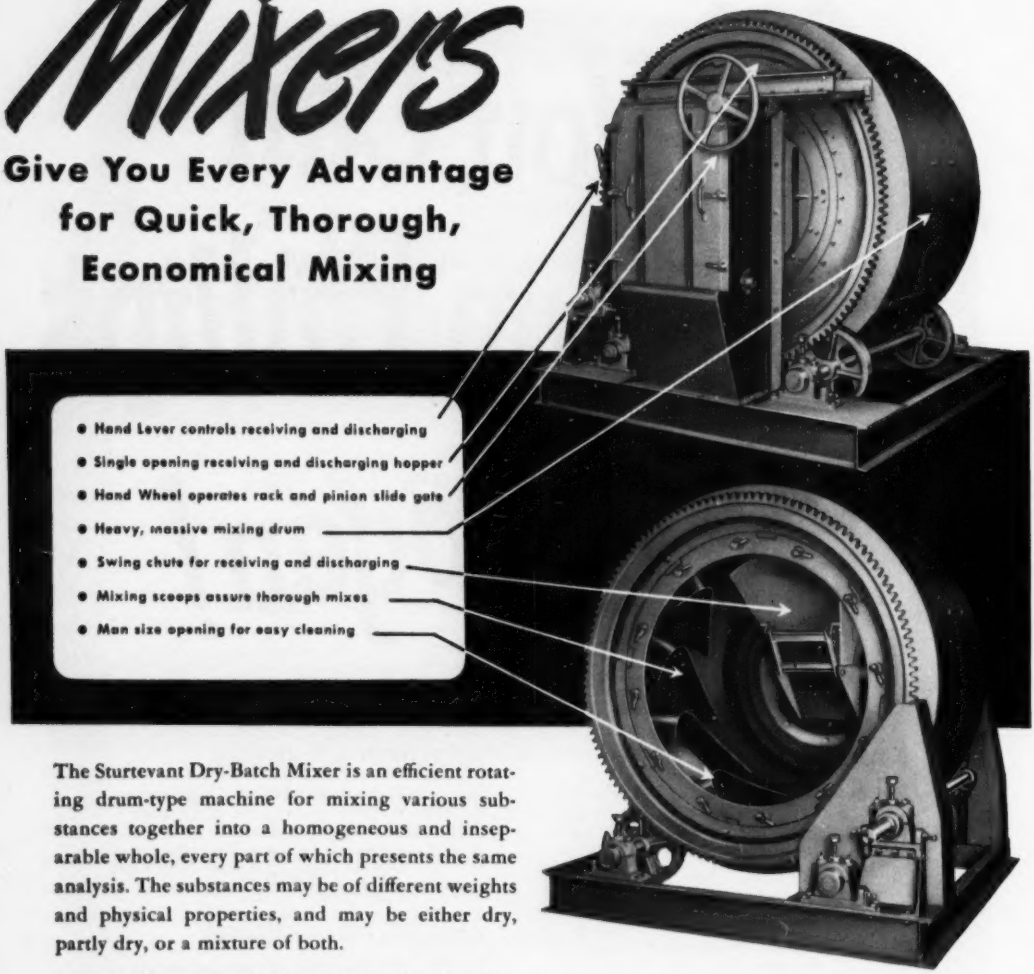
DISTRICT SALES OFFICES:

NORFOLK—610 Royster Bldg. • TAMPA—7 Terrace Office Bldg. • HOUSTON—604 City National Bank Bldg. • OMAHA—WOW Building
AMARILLO—First National Bank Bldg. • LOS ANGELES—4521 Produce Plaza West • BARTLESVILLE—Adams Building

Sturtevant Dry Batch

Mixers

Give You Every Advantage for Quick, Thorough, Economical Mixing


• Hand Lever controls receiving and discharging
• Single opening receiving and discharging hopper
• Hand Wheel operates rack and pinion slide gate
• Heavy, massive mixing drum
• Swing chute for receiving and discharging
• Mixing scoops assure thorough mixes
• Man size opening for easy cleaning

The Sturtevant Dry-Batch Mixer is an efficient rotating drum-type machine for mixing various substances together into a homogeneous and inseparable whole, every part of which presents the same analysis. The substances may be of different weights and physical properties, and may be either dry, partly dry, or a mixture of both.

Because of the unique design of its mixing chamber, and the 4-way mixing action which brings two or more substances together, the Sturtevant Dry-Batch Mixer does a more rapid mixing job than other machines and, at the same time, it is complete and thorough in every particular.

Write for bulletin today.

Compare These Advantages

- Only one lever controls both receiving and discharging for simplicity of operation. Hand wheel operates rack and pinion slide at feed opening.
- 4-way mixing action speeds production...assures thorough blends.
- "Open-door" accessibility permits easy, fast, thorough, cleaning.
- Single aperture drum for both intake and discharge.
- Unusually efficient scoops pick up materials to effect thorough mixing as drum revolves.
- 5 models . . . a size for every mixing job . . . smallest size mixes up to 7½ tons per hour . . . largest size up to 75 tons per hour.

STURTEVANT MILL COMPANY

111 Clayton Street, Boston 22, Mass.

Designers and Manufacturers of:

CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS
ELEVATORS • MIXERS
MECHANICAL DENS and EXCAVATORS

SULPHUR

*Interesting Facts Concerning This Basic Raw Material from the Gulf Coast Region

*MINING

The process of mining sulphur, as developed by Herman Frasch, takes advantage of the fairly low melting point of sulphur (about 240° Fahrenheit). The process resolves itself into three parts: one, operating a power plant that heats and pumps to the field large quantities of water; two, distributing the hot water through wells to melt the underground sulphur, and raising the melted sulphur to the surface; three, cooling and solidifying the sulphur in large vats from which it is broken and loaded into cars for shipment.

The power plant and water reservoir, as well as the vats and permanent structures, are placed at some distance from the sulphur deposit to avoid possibility of damage from surface subsidence, resulting from extraction of the underground sulphur.

Loading operations at our Newgulf, Texas' mine

TEXAS GULF SULPHUR CO. INC.

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- **Four forward and four *faster* reverse speeds up to 23 mph.**
- **Separate quick-acting forward-reverse shift.**
- **Full hydraulic control of bucket — lift, dump, close, lower.**
- **Automatic quick tip-back of bucket.**
- **Compact, stable and maneuverable.**
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- **Large pneumatic tires.**

WRITE for information on the Model HAH or other PAYLOADERS from 12 cu. ft. to 1½ cu. yd. capacity. Also ask for your copy of "Industrial Handling" the magazine of PAYLOADER uses.

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THE FRANK G. HOUGH CO. • Since 1920

Safety Council Fertilizer Section

Plans were made for a fertilizer industry safety program at the first meeting, held in Baltimore, May 16, of the advisory committee of a newly organized fertilizer section of the National Safety Council, under the chairmanship of A. B. Pettit, supervisor of industrial health and safety of The Davison Chemical Corporation. A formal program for nation-wide action will be presented at the October 11, 1951 National Safety Congress in Chicago.

"Although there are more than 500 fertilizer plants in the United States, there has never prior to this been any organized national effort to reduce the appalling frequency and severity of accident injuries occurring in the industry," Mr. Pettit said in announcing the appointment of the fertilizer section and the launching of the project at the meeting of the advisory committee. Last year Davison won two safety awards from the Naitonal Safety Council.

Serving on the section with Mr. Pettit, who is general chairman, are J. S. Fields, Phillips Chemical Co., Bartlesville, Okla., vice-chairman, and J. E. Smith, Spencer Chemical Co., Pittsburgh, Kansas, secretary-treasurer. The advisory committee consists of these officers and the following individual members: J. M. Sisson, Tennessee Valley Authority, Wilson Dam, Ala.; H. R. Krueger, Phillips Chemical Co., Bartlesville, Okla.; M. F. Wharton, Arizona Fertilizer Inc., Phoenix, Arizona; and R. L. Hugg, International Minerals and Chemicals Corp., Chicago, Ill.

Pointing out that many other industries have for years cooperated to conduct special sessions for the solution of specific problems at the National Safety Congress, Mr. Pettit said that industries which have conducted special aggressive programs have been well rewarded by a substantial reduction in the number and seriousness of their accidents and a decided decrease in the industrial illness experienced by employees.

The fertilizer industry is being urged to send representatives to the forthcoming meeting of the Congress where measures for reducing accidents and industrial illness, such as the exchange of health and accident information, the maintaining of proper records and the analysis of accident causes, will be discussed. Mr. Pettit reports widespread interest in the program among the companies, and the National Fertilizer Association and American Plant Food Council have indicated wholehearted support.

It Seems to Me

by BRUCE MORAN

The first of next month a stringent materials control program goes into effect. CMP . . . those initials will bedevil all industry.

For the time being the raw materials of our industry will not be affected. But when it comes to things we need that are made of metal—CMP will hit soon and hard.

It will be possible to build additional plant capacity. But it will not be easy to get the permit, the materials for the building or the new machinery to put into it. It will be possible, but it will be difficult. NPA, which administers CMP is a hard-working, well-intentioned group, run by men from industry, who know industry's troubles.

But they can do only one thing at a time . . . and your troubles will have to take their turn. So think ahead, plan ahead . . .and get your requisitions in early.

TABLE 1

Consumption of Commercial Fertilizer Mixtures and Separate Materials

Year Ended June 30, 1950[1]

State & Region	Commercial Mixtures			Separate Materials			All Fertilizers	Relative Consumption 1948-49 = 100	
	July 1 - Dec. 31, 1949	Jan. 1 - June 30, 1950	1949-50 Year Total	July 1 - Dec. 31, 1949	Jan. 1 - June 30, 1950	1949-50 Year Total	1949-50 Grand Total	All Fertilizers	Total Plant Nutrients[2]
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Percent	Percent
Maine	28,097	176,131	204,228	7,014	13,611	20,625	224,753	98	99
New Hampshire	3,234	12,884	16,118	2,685	9,213	11,898	28,016	108	117
Vermont	6,840	23,871	30,711	19,248	12,899	32,145	62,856	96	105
Massachusetts	7,076	41,286	48,362	4,576	16,264	20,840	69,202	97	96
Rhode Island	1,237	13,104	14,341	648	3,003	3,651	17,992	92	98
Connecticut	5,925	50,327	56,252	7,663	30,000	37,663	93,915	106	107
New England	52,409	337,603	390,012	41,832	84,690	126,722	516,734	99	101
New York	72,924	347,990	420,914	50,978	136,753	187,731	608,645	104	105
New Jersey	37,249	176,949	214,198	6,804	16,748	23,552	237,750	86	85
Pennsylvania	152,910	368,298	521,208	31,546	79,306	110,852	632,060	108	108
Delaware	14,893	39,481	54,374	867	2,446	3,133	57,507	101	104
District of Columbia	215	1,120	1,335	163	476	629	1,964	97	107
Maryland	75,847	146,715	222,562	9,200	20,185	29,385	251,747	102	103
West Virginia	11,242	48,360	59,602	8,851	26,695	44,846	104,148	102	110
Middle Atlantic	364,880	1,129,013	1,493,893	108,219	291,609	399,828	1,893,721	102	103
Virginia	138,780	448,299	584,079	29,040	115,185	144,225	728,304	102	103
North Carolina	210,582	1,182,928	1,393,510	78,695	270,143	346,838	1,740,348	95	98
South Carolina	62,989	550,037	613,026	46,116	215,386	261,502	874,528	86	89
Georgia	98,996	805,866	904,861	68,949	194,226	263,175	1,168,036	93	92
Florida	296,800	488,050	784,850	56,900	86,406	93,306	877,956	119	121
South Atlantic	827,947	3,452,179	4,280,126	277,700	881,345	1,129,046	5,409,171	98	99
Ohio	300,406	542,770	843,286	21,790	41,588	63,378	906,634	97	103
Indiana	187,168	516,293	703,439	38,118	59,910	98,028	798,467	97	103
Illinois	82,944	239,175	322,119	312,564	235,873	548,437	870,556	90	93
Michigan	125,554	283,233	408,787	14,642	51,056	65,698	474,485	102	107
Wisconsin	46,210	289,929	336,139	16,016	32,878	48,893	384,032	96	100
East North Central	741,340	1,871,400	2,612,740	400,129	421,305	821,434	3,434,174	95	101
Minnesota	19,526	124,342	143,868	12,324	61,804	74,128	217,996	87	92
Iowa	18,427	169,602	188,029	39,390	105,242	144,632	332,661	90	93
Missouri	92,650	170,582	263,232	53,667	90,811	144,478	407,710	105	108
North Dakota	2,411	9,940	12,351	1,292	5,028	6,320	18,671	87	98
South Dakota	462	2,045	2,507	524	2,465	2,989	5,496	87	87
Nebraska	1,712	7,633	9,345	5,905	28,817	34,322	43,667	116	128
Kansas	26,481	20,411	46,892	68,113	47,210	113,323	160,215	141	168
West North Central	161,669	504,555	666,224	178,815	341,377	520,192	1,186,416	100	106
Kentucky	49,911	296,891	346,802	80,859	126,429	207,288	554,090	101	108
Tennessee	59,033	281,520	340,553	51,436	114,349	165,785	506,338	101	109
Alabama	92,693	667,146	759,839	152,380	227,554	379,934	1,139,773	98	97
Mississippi	21,806	255,034	276,840	146,389	215,378	363,767	640,607	91	97
East South Central	223,443	1,500,591	1,724,034	403,064	713,710	1,116,774	2,840,808	97	101
Arkansas	6,389	144,430	150,819	45,766	124,068	167,821	318,640	101	108
Louisiana	22,083	130,868	152,421	39,789	82,380	122,169	274,590	110	116
Oklahoma	13,489	45,797	59,286	42,722	39,258	81,980	141,266	139	155
Texas	42,656	210,186	252,814	174,346	126,375	300,721	553,535	118	125
West South Central	84,587	530,753	615,340	300,625	372,066	672,691	1,288,031	112	120
Montana	137	2,012	2,149	2,216	6,592	8,808	10,957	118	136
Idaho	293	7,212	7,505	11,743	32,397	44,140	51,645	106	121
Wyoming	20	1,412	1,432	710	3,686	4,396	5,828	114	141
Colorado	2,561	16,033	17,594	7,049	14,800	21,849	39,143	109	119
New Mexico	27	662	689	7,081	11,471	18,552	19,241	136	168
Arizona	4,882	12,529	17,411	17,823	26,840	44,263	61,674	99	117
Utah	364	1,982	2,346	3,891	9,920	13,811	16,157	143	163
Nevada	57	272	329	405	390	795	1,124	155	125
Mountain	8,341	41,014	49,355	50,918	105,496	156,014	205,369	110	127
Washington	6,050	20,874	26,904	17,615	36,863	54,478	81,382	101	110
Oregon	4,192	20,527	24,719	24,928	47,216	72,142	96,861	127	131
California	64,127	99,905	164,032	405,822	466,447	872,269	1,036,301	97	107
Pacific	74,369	141,306	215,655	448,365	550,525	998,889	1,214,544	99	110
Continental U. S.	2,538,985	9,508,414	12,047,379	2,209,265	3,732,324	5,941,589	17,988,968	99	103
Hawaii	15,536	34,382	39,918	42,207	33,165	75,372	115,290	108	119
Puerto Rico	94,089	127,576	221,635	9,548	19,195	28,743	250,378	107	110
Territories[3]	109,595	151,958	261,553	51,755	52,360	104,115	365,668	107	113
Total, 1949-50	2,648,580	9,660,372	12,308,932	2,261,020	3,784,684	6,045,704[4]	18,354,636[5]	99	103
1948-49	3,216,721	9,622,785	12,839,506	2,307,273	3,395,106	5,702,379[5]	18,541,885[6]	100	100
1947-48	3,161,513	9,048,976	12,210,489	2,284,505	3,022,916	5,307,321[6]	17,518,401[7]	98	92

1/ Includes: ground phosphate rock, basic slag, minor element materials, such as borax, sulfur, manganese sulfate, etc. used as separate materials, also fertilizers distributed by Government agencies. Does not include liming materials, but includes gypsum.

2/ N, available P_2O_5, and K_2O.

3/ Consumption in Alaska not available, previous years approximately 500 tons.

4/ Includes 439,607 tons of materials not guaranteed to contain N, P_2O_5 or K_2O.

5/ Includes 509,865 tons of materials not guaranteed to contain N, P_2O_5 or K_2O.

6/ Includes 625,804 tons of materials not guaranteed to contain N, P_2O_5 or K_2O.

} minor and secondary element materials, principally gypsum.

COMMERCIAL FERTILIZER CONSUMPTION IN THE UNITED STATES 1949-50

By Walter Scholl and H. M. Wallace
Division of Fertilizer and Agricultural Lime
Bureau of Plant Industry, Soils and Agricultural Engineering
Agricultural Research Administration
U. S. Department of Agriculture
Beltsville, Maryland

Shipments of all commercial fertilizers, mixtures and separate materials, for consumption in the United States and its Territories decreased 187,249 tons or about one percent from the 18,541,885 tons shipped during the year ended June 30, 1949 to 18,354,636 tons shipped during the year ended June 30, 1950. The total plant-nutrient content (N, available P_2O_5, and K_2O), however, increased 126,801 tons or about three percent from 3,934,728 tons in 1948-49 to 4,061,529 tons in 1949-50. The weighted average nutrient content of the commercial mixtures used also increased about three percent from 22.55 percent in 1948-49 to 23.24 percent in 1949-50.

The data herewith show the number of tons of fertilizer reported shipped by manufacturers throughout the forty-eight states and the territories. The amount of nutrients supplied by commercial fertilizers was computed from the tonnages determined in this survey on the basis of analyses reported in state official publications. The weighted average nutrient content of commercial mixtures was determined from the grades and tonnages reported for each State and the average overrun or underrun. Fertilizer manufacturers, state fertilizer control officials and agronomists cooperated freely in providing information for this 11th annual survey.

Total Consumption

In 28 States and the Territories consumption was larger than in 1948-49, as indicated in Table 1. Included were most of the States located in the Middle Atlantic, West South Central, Mountain and Pacific Regions. Total increase in shipments in these States and Territories amounted to 541,077 tons. In contrast, however, shipments in the remaining States decreased 728,326 tons. The average shipments in 22 States increased in 1948-49, 11 percent above those in 1947-48, but in 1949-50 averaged 5 percent less than in 1948-49. In 14 other States 1948-49

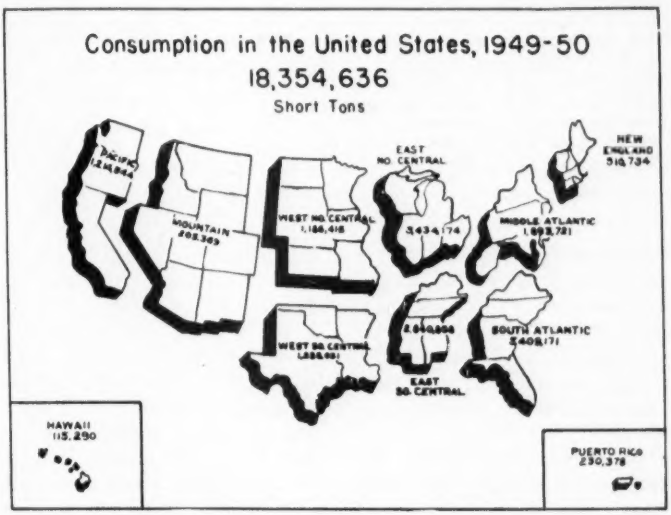

TABLE 2

Consumption of Mixed Fertilizers in the Continental United States,

Year Ended June 30, 1950, by Principal Grades, with Comparison for Year Ended June 30, 1949

Grade	Consumption Year Ended June 30,		Proportion of Total Year Ended June 30,		Grade	Consumption Year Ended June 30,		Proportion of Total Year Ended June 30,	
	1950	1949	1950	1949		1950	1949	1950	1949
	Tons	Tons	Percent	Percent		Tons	Tons	Percent	Percent
0-0-6	19,539	9,568	0.16	.08	5-7-10	11,341	19,623	.09	.16
0-9-27	35,061	32,367	.29	.26	5-8-7	31,031	36,741	.26	.29
0-10-20	18,955	30,261	.16	.24	5-10-5	872,377	993,446	7.24	7.89
0-12-12	130,483	251,048	1.09	1.99	5-10-10	446,741	457,646	3.71	3.64
0-14-7	132,808	148,092	1.10	1.18	5-20-10	17,823	11,188	.15	.09
0-14-10	119,836	53,378	.99	.42	6-3-6	25,273	23,814	.21	.19
0-14-14	130,066	34,968	1.08	.28	6-6-6	27,105	16,490	.22	.13
0-16-16	13,172	12,248	.11	.10	6-6-8	13,763	9,803	.11	.08
0-20-10	85,799	94,776	.71	.76	6-6-9	16,286	4,884	.14	.04
0-20-20	116,880	67,935	.97	.54	6-8-4	287,405	416,528	2.38	3.31
2-12-6	879,784	1,315,872	7.30	10.45	6-8-6	287,053	276,710	2.38	2.20
2-12-12	198,765	159,128	1.65	1.26	6-8-8	168,758	116,711	1.40	.93
2-14-6	16,240	18,445	.13	.15	6-8-12	38,154	39,545	.32	.31
2-16-8	34,510	35,186	.29	.28	6-9-9	10,698	10,323	.09	.08
3-8-5	24,546	29,133	.20	.23	6-9-12	59,412	71,473	.49	.57
3-8-8	25,489	32,041	.21	.25	6-10-4	53,004	38,076	.44	.30
3-9-6	781,651	826,944	6.49	6.57	6-12-6	25,982	25,436	.22	.20
3-9-9	275,011	221,514	2.28	1.76	6-12-12	30,805	3,469	.26	.03
3-9-12	29,132	30,973	.24	.25	6-18-6	11,860	12,872	.10	.10
3-9-18	128,934	119,885	1.07	.95	7-7-7	50,892	53,765	.42	.43
3-12-6	803,326	859,699	6.67	6.83	8-0-8	12,928	10,570	.11	.08
3-12-12	1,221,725	971,954	10.14	7.72	8-8-4	19,646	21,651	.16	.17
3-18-9	154,636	145,012	1.28	1.15	8-8-8	89,392	73,111	.74	.58
4-6-6	12,210	7,639	.10	.06	8-10-12	10,085	10,876	.08	.09
4-8-8	82,103	76,714	.69	.61	8-12-16	29,484	25,559	.24	.20
4-7-5	118,368	111,134	.98	.88	8-16-16	38,432	37,117	.33	.29
4-8-4	16,016	15,231	.13	.12	8-24-8	12,880	556	.11	.00
4-8-6	559,931	612,662	4.65	4.87	8-32-0	11,517	120	.10	.00
4-8-8	221,469	217,638	1.84	1.73	10-0-10	15,468	21,873	.13	.17
4-8-12	72,036	72,935	.60	.58	10-6-4	26,324	29,028	.22	.23
4-9-3	81,701	73,408	.68	.58	10-10-0	18,641	23,711	.15	.19
4-10-4	37,176	52,582	.31	.42	10-10-5	38,067	46,917	.32	.37
4-10-6	622,372	809,605	5.17	6.43	10-10-10	32,071	15,058	.27	.12
4-10-7	386,671	418,689	3.21	3.33	10-16-8	10,194	7,554	.08	.06
4-12-4	432,923	554,954	3.59	4.41	10-20-0	33,714	18,579	.28	.15
4-12-6	15,054	5,597	.12	.04	14-0-14	11,446	9,699	.10	.08
4-12-8	276,994	263,539	2.30	2.09	17-7-0	21,433	32,717	.18	.26
4-12-12	20,614	15,835	.17	.13					
4-16-0	53,999	94,686	.45	.75	81 mixtures	11,492,861	12,069,373	95.40	95.87
4-16-8	45,617	41,265	.38	.33	Other specified grades1/	359,420	367,011	2.98	2.92
4-16-16	44,080	26,885	.36	.21	Miscellaneous2/	195,088	162,081	1.62	1.21
4-24-12	62,263	36,909	.52	.30					
5-5-20	17,693	15,524	.15	.12	Total	12,047,369	12,588,465	100.00	100.00
5-7-6	19,889	22,106	.16	.18					

1/ There were 846 in 1949-50 and 813 in the 1948-49 season.

2/ Grade not reported.

distribution averaged 20 percent less than in 1947-48, but in 1949-50 averaged 11 percent more than in 1948-49. In 12 States shipments have shown a continued increase, with an average of 6 percent in 1948-49 and 13 percent in 1949-50.

In only a few States, New Jersey, South Carolina, Minnesota, and the Dakotas, were shipments less than 90 percent of their 1948-49 deliveries. The distribution of the total shipments was 43 percent in the Atlantic Coast States, 47 percent in the Central States, 8 percent in the Mountain and Pacific States, and 2 percent in the Territories. Shipments in the January-June, 1950 period amounted to 13,445,056 tons or 73.2 percent of the total, as compared with 70.2 percent for the corresponding period in 1949.

Mixtures

Commercial mixtures amount to 12,308,932 tons and represent 67.0 percent of the total deliveries of all fertilizers in 1949-50, as compared with 12,839,506 tons or 69.2 percent for 1948-49. Shipments of mixtures were,

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OKLAHOMA CITY • PORTLAND, ORE. • REIDSVILLE, N. C. • HARLINGEN, TEXAS • CHAGRIN FALLS, O. • WORCESTER, MASS. • CROSSETT, ARK. • SAN FRANCISCO

therefore, 530,574 tons less than in 1948-49. Distribution was less in all Regions except the West South Central Region and the Territories. More than half of the decrease was in the East North Central and the East South Central Regions.

The total number of grades sold in Continental United States was 927. Included were 468 grades with sales less than 100 tons each. In addition there were possibly 100 or more not listed by grade. The tonnages of all grades distributed in Continental United States in excess of ten thousand tons each are in Table 2, together with the tonnages distributed in 1948-49. The total tonnage of these 81 grades amount to 11,492,871 tons and represent more than 95 percent of the total tonnage of all mixtures in 1949-50.

Grade 3-12-12 replaced the 2-12-6 as the one selling in largest tonnage in the United States. Distribution of grade 3-12-12 amounted to 1,221,725 tons or 10.14 percent of the total tonnage of all mixtures. Grades 2-12-6, 5-10-5, 3-12-6, and 3-9-6, in this order, were the grades selling in the next largest tonnage. The tonnage of these five grades was 4,558,862 tons or 37.84 percent of the total for all mixtures in 1949-50.

The 15 grades sold in greatest tonnage in each Region are in Table 3. In all but eight States these 15 grades represent 80 percent (in most States 90 percent) or more of the total shipments, but in Florida they represent only 48, Utah 51, Nebraska 55, and Wyoming 59 percent. These 15 grades include the 10 prin-

TABLE 3

State	No. of Mixtures	5-10-10	6-9-12	0-14-14	5-8-7	8-12-16	6-9-6	0-20-20	8-16-16	7-7-7	8-7-10	6-9-9	8-10-5	8-12-12	4-12-4	8-9-10	All Other Mixtures	Total
New England																		
Maine	49	30,085	58,772	23,672	5,697	29,251	0	117	10,678	760	11,341	10,698	885	5,756	446	3,403	12,281	204,229
New Hampshire	34	4,712	0	666	1,421	112	0	4,618	1,217	1,063	0	0	220	321	331	0	1,646	16,110
Vermont	38	4,704	0	3,786	819	0	12	9,668	3,761	949	0	0	315	68	590	0	3,865	30,711
Massachusetts	37	17,211	0	1,957	11,582	66	9,498	3,282	2,449	6,987	0	0	4,457	179	2,174	0	9,560	69,362
Rhode Island	36	6,695	0	881	1,716	0	0	34	248	946	0	0	836	73	412	0	2,902	14,341
Connecticut	82	8,796	0	1,330	9,469	0	15,754	3,183	969	3,372	0	0	1,223	801	2,776	0	8,570	56,282
Total	86	74,204	58,772	32,182	31,054	29,429	25,273	20,932	19,542	14,086	11,341	10,698	7,936	7,198	6,729	3,403	37,312	390,012
Middle Atlantic																		
		3-12-6	5-10-10	5-10-5	4-12-6	4-8-12	4-12-4	0-14-7	6-12-6	3-9-12	0-12-12	0-20-20	6-12-8	10-10-10	7-7-7	6-8-6		
New York	81	43,100	85,321	166,818	5,163	26,623	13,316	1,041	23,256	1,608	974	6,269	34	8,261	3,179	184	45,893	430,914
New Jersey	85	13,146	99,027	29,153	25,580	7,175	1,906	13,906	497	13,808	2,897	1,821	4	1,747	6,629	73	19,168	216,136
Pennsylvania	68	280,140	92,750	26,105	22,181	12,676	23,104	13,901	2,621	827	9,692	6,477	18,177	4,491	1,985	137	30,532	521,206
Delaware	41	18,783	3,101	3,899	6,146	3,981	259	1,753	0	3,648	2,213	680	0	130	22	1,018	7,821	54,374
District of Columbia	19	154	2	548	4	165	43	6	0	0	0	0	0	3	8	16	419	1,365
Maryland	72	107,443	9,041	17,178	11,109	21,644	2,425	7,784	0	8,267	9,571	331	70	161	2,776	11,617	17,946	222,562
West Virginia	31	17,219	9,943	3,628	4,730	5	10,042	9,969	0	0	549	1,749	108	209	43	81	2,429	59,602
Total	117	480,282	279,145	239,623	75,523	68,954	50,181	34,859	25,944	28,458	17,996	16,107	18,393	15,002	14,642	12,997	129,807	1,493,893
South Atlantic																		
		4-10-6	3-9-6	4-8-6	3-12-6	3-9-9	5-10-5	2-12-12	6-8-8	4-8-8	4-7-6	0-14-14	4-6-6	6-9-3	4-12-4	5-10-10		
Virginia	47	13,246	65,664	0	170,703	4,845	57,546	81,321	28,124	19	0	29,239	0	4,235	80,705	8,499	64,823	604,079
North Carolina	29	367,006	439,341	0	98,551	77,913	82,585	93,654	70,588	0	0	67,273	0	47,424	16,342	36,653	78,079	1,393,610
South Carolina	32	240,523	72,022	234	23,842	133,182	61,959	0	8,625	32,076	0	646	0	0	3,995	2,211	33,596	613,026
Georgia	67	10,488	66,999	501,576	4,148	66,836	16,366	7,658	80,269	52,709	0	441	0	4,716	2,993	2	130,969	904,861
Florida	565	835	76	58,288	27	1,916	5,069	335	6,986	67,879	119,568	14	81,906	25,317	3,704	2,783	411,175	784,850
Total	605	632,098	611,122	559,898	297,271	274,694	192,826	182,968	194,782	152,682	119,568	98,532	81,906	81,691	64,637	50,108	758,741	4,280,124
East North Central																		
		3-12-12	2-12-6	3-10-9	4-12-8	0-12-12	3-9-18	0-20-10	0-20-20	2-16-8	5-10-10	8-8-8	0-9-27	6-16-16	4-16-8	0-14-7		
Ohio	46	276,346	314,538	57,268	34,397	19,061	3,077	2,259	7,606	0	38,653	4,887	368	838	5,772	8,957	77,246	843,256
Indiana	64	369,480	146,881	37,201	25,564	29,978	19,482	1,989	12,641	8	1,900	10,845	6,409	2,217	257	2,646	37,820	703,439
Illinois	65	195,148	83,299	25,209	26,844	23,211	29,235	4,391	10,977	0	0	11,496	4,108	6,271	62	423	28,009	322,119
Michigan	57	117,104	121,697	30,385	16,716	12,117	7,786	4,391	10,976	54,412	48	11,405	2,261	9,150	3,422	2,171	27,046	409,787
Wisconsin	56	143,481	20,400	10,379	15,624	10,345	16,912	44,028	19,497	0	0	6,061	12,504	6,281	1,216	19,811	135,139	
Total	109	1,085,902	692,303	141,012	115,512	80,369	73,224	57,348	84,187	54,415	34,108	33,998	25,654	24,748	18,294	15,813	189,873	2,812,740

CONTINUATION TABLE 3

West North Central

State	No. of Mixtures[1]	4-12-4	3-12-12	2-12-6	4-24-12	4-16-0	0-20-10	0-20-20	4-16-8	10-20-0	4-12-8	3-9-18	4-16-16	3-18-9	8-8-8	8-32-0	All Other Mixtures	Total
Minnesota	62	66	24,396	260	27,799	136	22,346	13,672	8,043	691	93	534	15,783	4,671	66	590	27,552	145,868
Iowa	71	4,394	50,296	12,105	757	31,321	2,665	1,666	16,274	7,046	17,303	2,836	2,590	5,970	1,847	6,030	24,907	188,029
Missouri	40	87,263	28,632	59,143	16,462	1,668	2,054	6,870	1	1,918	2,563	16,321	4	711	9,447	0	33,178	263,232
North Dakota	45	40	1,186	242	3,944	68	323	168	117	96	27	5	919	791	148	312	3,998	12,381
South Dakota	24	98	23	7	10	1,368	13	7	17	284	14	0	3	170	6	3	494	2,907
Nebraska	36	119	37	8	7	2,259	0	2	0	1,886	45	0	0	28	7	760	4,186	9,345
Kansas	38	10,698	206	6,739	309	8,872	191	113	19	8,216	20	0	0	0	487	3,815	7,308	46,892
Total	127	102,868	101,745	78,804	49,288	45,392	27,592	22,520	21,471	20,136	20,065	19,696	19,269	12,541	12,008	11,510	101,619	666,224

East South Central

		4-10-7	6-8-4	3-9-6	5-10-5	6-8-8	2-12-6	8-8-8	0-14-10	4-12-4	4-8-8	4-12-8	4-16-4	6-12-12	0-14-7	0-12-12		
Kentucky	51	0	0	51,547	3,010	57	93,566	99,397	0	14,065	40	44,945	0	2,256	6,756	6,980	24,215	346,802
Tennessee	49	34	15,120	116,828	9,020	7,505	25,043	8,455	37	46,480	57,047	3,926	0	20,276	7,434	6,061	15,297	340,563
Alabama	27	345,749	229,292	3	1,520	45,886	4	68	85,600	22	53	0	34,502	0	0	8	17,143	759,839
Mississippi	17	14,088	40,107	0	143,229	72,460	0	18	2,662	30	59	0	0	0	304	21	3,882	276,840
Total	82	359,841	282,519	170,378	156,779	125,897	118,613	107,928	88,319	62,597	57,199	48,871	34,502	22,532	14,494	13,030	60,536	1,724,034

West South Central

		5-10-5	4-12-4	6-8-12	3-9-18	8-8-8	0-14-7	6-10-4	6-8-8	4-8-8	4-12-8	3-12-12	4-16-0	10-20-10	12-12-12	10-10-0		
Arkansas	30	53,304	18,646	34,085	33,528	3,002	667	324	1,308	2,163	0	117	0	352	2,328	0	977	150,819
Louisiana	27	48,786	36,430	2,153	61	22,344	3,984	4,010	11,156	1,689	8,814	7,788	0	254	1,041	162	2,770	152,421
Oklahoma	30	25,615	22,908	18	499	264	1,069	966	98	2	0	19	5,040	173	166	161	2,398	59,286
Texas	18	130,232	58,974	514	0	6,869	25,636	9,456	0	6,694	63	232	0	3,675	0	2,876	7,674	252,814
Total	50	257,836	136,958	36,770	34,088	33,499	31,345	14,756	12,562	10,548	8,877	8,156	5,040	4,354	3,633	3,199	13,819	615,340

Mountain

		10-20-0	10-10-0	10-16-8	12-24-0	10-10-10	6-30-0	10-10-5	6-24-6	7-21-7	10-16-5	10-12-8	10-20-10	10-20-5	6-10-4	5-10-5		
Montana	16	1,045	8	10	0	0	219	20	0	0	809	0	0	0	0	0	336	2,149
Idaho	24	1,294	2,245	696	0	5	589	998	0	0	186	0	0	0	122	0	1,461	7,506
Wyoming	18	141	29	0	273	0	11	1	0	0	370	0	18	0	0	0	589	1,432
Colorado	30	1,149	186	3,731	3,680	1,567	597	249	1,423	1,326	15	979	0	0	0	594	2,328	17,594
New Mexico	12	81	20	0	0	0	0	1	0	0	0	0	81	0	177	282	47	689
Arizona	34	6,820	7,133	0	0	736	0	277	0	0	0	0	774	786	25	0	2,100	17,611
Utah	32	342	63	11	0	0	366	22	0	0	64	0	0	0	268	0	1,090	2,246
Nevada	7	114	0	0	0	0	0	24	0	0	0	0	0	0	152	0	39	329
Total	82	9,746	9,674	4,857	3,953	2,308	1,782	1,592	1,423	1,326	1,144	979	873	786	744	876	7,992	49,555

Pacific

		10-10-5	17-7-0	6-8-4	6-10-4	5-10-10	8-10-12	6-9-6	15-8-4	10-16-8	3-10-10	5-6-8	10-20-0	4-10-10	10-12-10	10-10-0		
Washington	80	1,705	188	0	4,778	7,772	0	0	0	344	1,699	1,451	37	0	0	15	8,915	26,904
Oregon	46	532	10	20	1,634	3,361	0	0	0	5,195	1,582	1,625	639	0	0	274	9,949	24,719
California	61	33,754	21,156	19,260	10,212	0	9,986	9,665	6,928	298	0	0	2,160	2,594	2,575	2,089	43,366	164,032
Total	116	36,991	21,354	19,280	16,624	11,133	9,986	9,665	6,928	5,837	3,281	2,974	2,826	2,594	2,575	2,378	62,229	215,655

Territories[2]

		14-6-10	14-4-10	14-6-8	7-8-10	15-3-12	10-10-5	10-6-16	12-6-8	6-9-10	12-6-14	14-6-6	18-4-7	12-6-10	14-4-8	14-3-10		
Puerto Rico	43	63,184	32,383	22,602	22,519	11,106	7,655	7,376	6,065	4,201	3,912	3,429	3,080	2,668	2,286	1,822	7,378	221,636

1/ The number of mixtures shown for each State and region is exclusive of special or miscellaneous mixtures not specified by grade, although their tonnages are included in the totals.
2/ All 92 grades consumed in Hawaii are produced by one manufacturer to comply with specifications by consumers.

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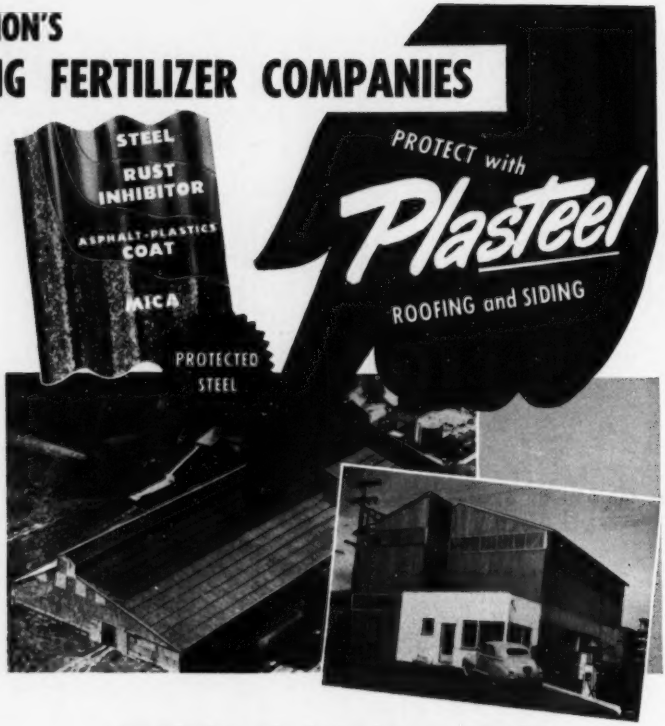

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cipal grades that were used during 1948-49 with the following exceptions. Only 3,374 tons of the 6-9-15 were shipped in Maine compared with 10,091 tons in 1948-49. In the East North Central Region the 2-12-12 dropped from 44,775 tons to 2,901 tons, the 12-15-0 from 2,267 tons to 229 tons in the Mountain Region and the 4-12-4 from 5,109 tons to 2,301 tons in the Pacific Region. Although the principal grades have remained practically the same as for 1948-49, the order of their importance is somewhat different. The first two grades in each of the Regions, however, were the same grades as in 1948-49.

The weighted average nutrient content of commercial mixtures ranged from 18.72 percent in Georgia to 36.25 percent in North Dakota, as shown in Table 4. The averages were higher in practically all States than for 1948-49. The United States average for nitrogen was 4.02 percent, available P_2O_5 10.93 percent, and K_2O 8.29 percent. The average for nitrogen was higher by 0.03 percent than for 1948-49 and lower by 0.02 percent than for 1947-48. Available P_2O_5 increased by 0.15 percent and 0.07 percent whereas K_2O increased by 0.51 percent and 0.63 percent in comparison with 1948-49 and 1947-48, respectively. The most significant change in composition of commercial mixtures over previous years was a higher content of potash.

Separate Materials

Shipments in each State of separate materials for direct use on the land or for farm mixing, as itemized in Table 5, amount

TABLE 4

Weighted Average Plant-Nutrient Content of Commercial Mixtures Consumed in the United States, Year Ended June 30, 1950 and 1949

State & Region	Year Ended June 30, 1950				Year Ended June 30, 1949
	Nitrogen	Available Phosphoric Oxide	Potash	Total	Total
	Percent	Percent	Percent	Percent	Percent
Maine	5.71	11.02	12.78	29.51	28.70
New Hampshire	3.88	13.67	13.26	30.71	27.15
Vermont	3.17	15.24	15.06	33.47	29.72
Massachusetts	5.31	9.91	9.19	24.41	25.20
Rhode Island	5.01	10.24	10.88	26.13	24.86
Connecticut	5.34	8.83	8.79	22.96	21.96
New England	5.28	10.92	11.71	27.91	27.02
New York	4.93	11.36	7.98	24.27	23.71
New Jersey	4.61	10.66	9.40	24.67	24.72
Pennsylvania	3.70	12.36	7.84	23.90	23.74
Delaware	3.45	11.61	8.75	23.69	23.01
District of Columbia	5.99	9.61	9.44	24.94	21.70
Maryland	3.58	11.61	7.80	22.89	22.74
West Virginia	3.24	12.77	7.43	23.44	22.55
Middle Atlantic	4.14	11.69	8.12	23.95	23.68
Virginia	3.09	10.86	7.80	21.75	21.46
North Carolina	3.55	9.87	7.48	20.90	20.72
South Carolina	3.78	9.88	7.10	20.76	20.76
Georgia	3.91	8.69	6.12	18.72	18.96
Florida	4.61	7.29	7.26	19.06	18.75
South Atlantic	3.77	9.28	7.14	20.19	20.12
Ohio	2.80	12.78	9.51	25.09	23.54
Indiana	2.70	12.65	11.42	26.77	25.84
Illinois	3.14	12.15	12.19	27.48	26.57
Michigan	2.56	13.91	10.25	26.71	25.26
Wisconsin	2.42	14.12	13.10	29.64	27.62
East North Central	2.73	13.02	10.93	26.68	25.27
Minnesota	2.99	19.08	13.10	35.17	33.05
Iowa	3.82	15.35	7.59	26.76	25.09
Missouri	3.62	13.40	8.25	25.27	22.93
North Dakota	3.51	22.98	9.76	36.25	32.20
South Dakota	5.42	16.75	1.40	23.57	21.32
Nebraska	8.39	21.05	1.48	30.92	26.81
Kansas	6.53	17.03	2.74	26.30	21.60
West North Central	3.82	15.73	8.63	28.18	25.76
Kentucky	3.76	10.38	8.26	22.40	21.06
Tennessee	3.70	10.20	7.06	20.96	20.03
Alabama	4.21	9.70	6.60	20.51	19.91
Mississippi	5.42	9.48	6.12	21.02	21.13
East South Central	4.22	9.90	6.95	21.07	20.38
Arkansas	4.81	9.96	9.85	24.62	24.05
Louisiana	5.18	10.77	6.44	22.39	21.48
Oklahoma	4.46	14.58	6.00	25.14	20.28
Texas	4.43	11.49	5.33	21.25	20.28
West South Central	4.71	11.24	6.78	22.73	21.62
Montana	9.45	19.36	2.23	31.04	31.60
Idaho	9.85	14.74	2.61	27.20	26.27
Wyoming	9.00	20.47	2.85	32.32	34.44
Colorado	9.50	18.77	5.80	34.07	34.59
New Mexico	6.82	13.36	5.22	25.39	25.47
Arizona	10.37	16.27	1.52	27.16	26.15
Utah	9.08	15.98	2.85	27.91	27.70
Nevada	7.60	13.98	3.34	24.92	24.86
Mountain	9.81	16.84	3.42	30.07	29.40
Washington	6.09	11.07	9.47	26.63	25.32
Oregon	7.31	14.14	9.20	30.65	29.73
California	10.13	9.96	5.36	25.47	24.58
Pacific	9.30	10.89	6.31	26.20	25.13
Continental U. S.	3.88	11.03	8.23	23.14	22.47
Hawaii	11.68	8.01	15.40	35.09	35.72
Puerto Rico	10.69	6.18	9.94	26.81	25.65
Territories	10.84	6.46	10.78	28.08	27.13
U. S. Average: 1949-50	4.02	10.93	8.29	23.24	
1948-49	3.99	10.78	7.78	22.55	
1947-48	4.04	10.71	7.15	21.90	

TABLE 5

Principal Fertilizer Materials Consumed as such, by States and Regions,

During Year Ended June 30, 1950[1]

Tons

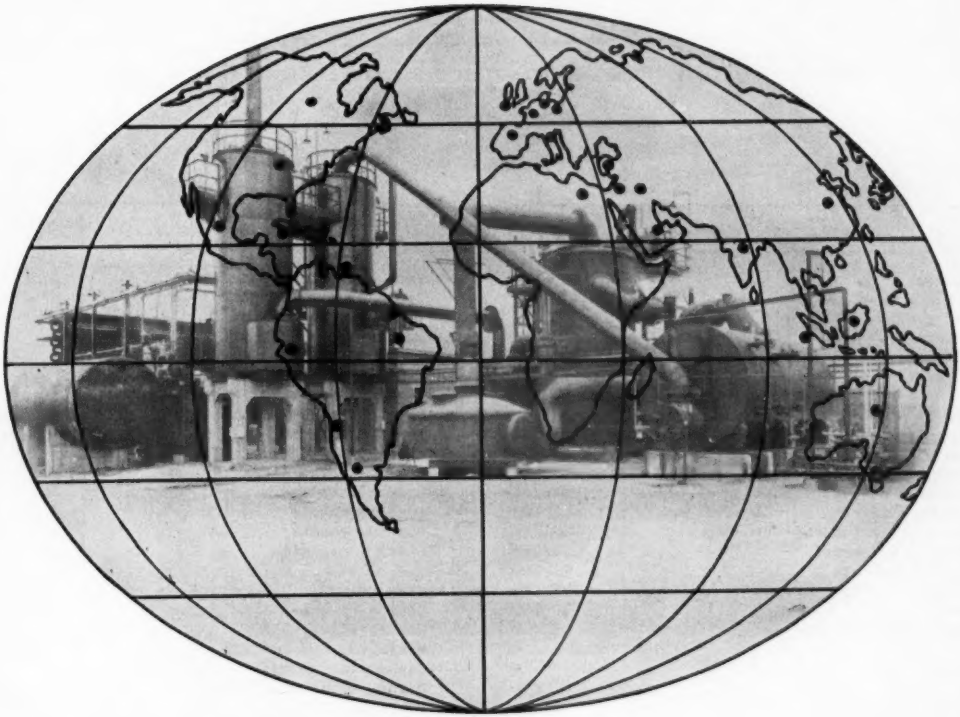
State & Region	Ammonium Nitrate	Ammonium Sulfate	Calcium Cyanamide	Sodium Nitrate	Other Chemical Nitrogen Materials[2]	Dried Manures	Other Organics[2]	Phosphate Rock[3]	Superphosphates 16-20 Percent	Superphosphates 35-50 Percent	Other Phosphates[3]	Muriate of Potash 50 & 60%	Other Potash Salts[3]	Minor and Secondary Elements[4]	Total
Maine	896	536	292	480	35	651	149	74	17,725	0	121	25	3	36	20,528
New Hampshire	226	41	56	218	22	406	186	40	10,261	33	160	189	67	14	11,898
Vermont	163	1	20	169	67	72	159	112	30,721	0	201	397	0	93	32,146
Massachusetts	488	321	216	1,472	99	1,989	4,017	331	10,430	0	945	555	0	17	20,860
Rhode Island	43	12	19	162	12	381	663	0	2,222	0	130	89	4	14	3,551
Connecticut	287	45	67	1,280	113	803	17,429	352	12,258	25	1,386	1,411	1,793	396	37,965
New England	1,793	734	670	3,771	338	4,361	22,503	899	83,627	58	2,903	2,636	1,867	572	126,722
New York	3,446	439	1,905	4,805	991	2,749	4,989	630	166,829	48	911	616	92	411	187,731
New Jersey	775	144	1,295	2,735	147	2,175	1,666	331	10,025	4	1,320	1,119	23	1,897	23,652
Pennsylvania	800	342	928	3,395	230	3,649	3,558	3,398	90,751	63	1,799	586	68	2,325	110,682
Delaware	554	1	48	282	50	116	36	100	1,875	0	45	18	1	9	3,133
District of Columbia	0	0	1	63	0	181	185	0	44	0	114	1	0	40	629
Maryland	440	21	632	3,156	592	1,024	140	341	22,449	0	380	176	18	216	29,385
West Virginia	102	203	16	839	278	196	61	80	29,212	3,484	69	34	0	2	44,546
Middle Atlantic	6,117	1,150	4,723	14,263	2,078	10,090	10,815	4,940	330,185	3,599	4,838	2,528	202	4,800	399,928
Virginia	2,920	864	1,222	20,714	10,008	473	642	270	74,626	7,491	4,078	669	151	10,097	144,225
North Carolina	9,902	1,061	23,909	161,145	43,541	93	3,441	610	47,276	1,345	12,167	7,300	3,975	30,206	346,838
South Carolina	13,664	1,068	5,528	103,079	34,089	180	749	1,178	71,861	43	10,046	9,467	7,210	3,295	261,808
Georgia	12,808	4,803	1,945	96,267	12,221	587	928	375	94,459	486	27,422	7,860	6,090	17,456	283,175
Florida	4,038	1,267	3,068	14,289	6,841	1,068	7,527	12,136	17,489	63	6,998	3,063	14,344	3,179	93,308
South Atlantic	42,352	8,873	34,670	406,482	106,700	2,371	13,287	14,465	306,651	9,408	60,699	28,359	31,800	64,230	1,129,046
Ohio	4,275	5,550	2,009	1,371	1,611	1,655	6,753	8,217	28,764	3,669	1,175	222	25	0	63,378
Indiana	19,745	471	1,693	409	690	1,580	58,342	28,448	2,915	298	1,797	177	134	95,028
Illinois	14,916	1,008	870	277	95	4,072	8,416	452,808	41,609	5,880	3,081	14,640	3,351	16	548,437
Michigan	5,733	1,806	147	715	259	1,222	7,086	2,330	44,446	648	156	457	1	613	65,898
Wisconsin	6,698	320	301	59	170	676	3,571	10,884	22,270	851	407	1,436	1,036	342	48,893
East North Central	51,367	9,055	4,820	2,831	2,825	9,215	25,346	510,941	163,559	13,863	5,117	18,452	4,592	1,106	821,454
Minnesota	3,362	143	2	0	180	649	2,566	3,390	40,266	20,923	1,423	201	0	1,064	74,128
Iowa	16,782	252	180	0	108	100	1,212	28,097	82,165	11,856	5,659	1,576	4	162	144,632
Missouri	23,124	305	42	214	2,047	464	1,813	75,372	23,996	14,966	513	2,267	235	0	144,478
North Dakota	304	45	0	0	24	0	28	180	618	4,372	351	0	0	400	6,320
South Dakota	530	0	0	0	40	18	90	128	1,815	635	0	0	0	40	2,989
Nebraska	22,676	869	0	0	180	78	252	808	5,932	8,557	518	87	0	6	54,822
Kansas	25,427	1,421	1	8	57	199	410	26,961	12,316	46,676	778	89	4	0	113,523
West North Central	91,107	3,036	226	219	2,636	1,704	6,368	130,931	164,903	104,484	9,242	4,000	245	1,662	520,192
Kentucky	19,297	404	2,242	1,929	206	247	246	24,802	136,315	14,134	2,702	878	3,747	102	207,288
Tennessee	22,464	1,122	978	16,494	3,436	382	897	1,906	82,264	10,807	22,375	2,940	1,491	239	166,795
Alabama	34,792	3,388	1,421	57,881	1,392	545	194	460	96,490	2,064	143,308	4,921	2,870	520	379,934
Mississippi	103,670	16,135	7,764	46,418	31,280	33	50	1,169	64,445	1,947	74,780	13,998	2,070	8	363,747
East South Central	180,223	21,049	12,405	121,462	36,314	1,206	1,086	27,957	379,512	28,642	243,165	22,737	10,178	869	1,116,774
Arkansas	48,213	1,660	6,740	18,447	6,690	19	58	554	69,980	2,470	676	9,462	8,209	3	167,821
Louisiana	29,210	1,644	2,076	24,081	8,962	56	1,314	8,116	27,159	944	15,803	4,673	441	0	122,169
Oklahoma	4,083	470	0	163	52	214	221	30,182	41,606	4,134	642	228	5	0	81,980
Texas	18,971	5,318	5,739	2,082	1,901	1,471	969	15,817	176,272	26,007	41,051	785	16	4,752	300,721
West South Central	100,477	8,992	14,555	44,743	17,435	1,760	2,562	54,149	315,017	33,555	58,172	15,148	3,671	4,755	672,691
Montana	0	110	0	0	80	0	90	0	12	8,124	0	2	0	390	8,808
Idaho	3,195	8,796	0	0	320	0	30	0	19,720	11,982	242	63	0	3,794	44,140
Wyoming	240	54	0	0	48	0	0	10	788	3,030	60	6	0	202	4,396
Colorado	2,192	5,804	20	175	120	151	660	40	1,475	11,219	815	548	120	442	21,849
New Mexico	1,394	685	80	61	2,485	0	736	0	995	5,806	6,401	40	0	0	18,863
Arizona	6,651	905	881	1,236	11,454	2,068	112	40	2,515	5,613	4,950	0	342	8,436	44,265
Utah	2,094	1,647	0	0	201	300	90	260	4,361	3,348	700	30	0	800	13,811
Nevada	0	3	0	0	0	5	0	0	44	410	0	0	0	333	795
Mountain	16,766	18,994	981	1,472	14,888	2,494	1,707	340	25,870	49,532	13,136	687	462	14,097	166,014
Washington	5,714	5,400	293	804	2,712	3,024	4,006	3,235	10,862	3,008	10,453	2,464	71	2,454	54,478
Oregon	11,089	16,239	562	862	2,087	3	753	402	15,099	4,934	13,520	1,665	208	5,780	72,142
California	54,621	90,620	5,673	1,458	72,275	130,000[4]	39,421	529	60,642	14,132	58,083	2,675	2,882	339,258	872,269
Pacific	71,394	111,259	6,528	3,124	77,044	133,027	44,180	4,166	86,603	22,072	82,056	6,804	3,161	347,492	998,889
Continental U. S.	589,584	179,420	81,577	627,367	268,674	165,217	127,864	748,666	1,864,826	264,913	476,790	101,161	56,178	439,382	5,941,589
Territories	17,978	58,244	1	67	6,002	2	110	587	1,961	242	10,236	8,136	3,632	125	104,115
Total, 1949-50	607,562	234,664	81,578	627,434	264,676	165,219	127,964	749,253	1,856,777	265,155	487,026	109,289	59,810	439,507	6,045,704
1948-49	547,223	220,041	63,986	700,046	231,228	134,681	123,744	742,700	1,784,719	196,290	472,546	96,106	60,604	509,565	5,702,579
1947-48	347,547	211,225	74,068	597,490	146,601	99,830	103,096	777,427	1,847,297	166,061	499,856	56,729	54,710	625,804	5,607,321

1/ Includes distribution by Government agencies, materials for mixing on the farm, and gypsum. Excludes materials used by manufacturers in the formulation of commercial mixtures, and agricultural lime.

2/ Tonnages of principal commodities are shown in Table 6.

3/ Includes 20,720 tons of colloidal and soft phosphate.

4/ Estimated.



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More than 250 Monsanto-designed sulfuric acid plants are located in twenty-six countries throughout the world. Using Monsanto Vanadium Catalyst, these units produce about 40% of the free world's contact sulfuric acid. Monsanto plants are not limited to elemental sulfur. They are working with all known raw materials.

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2. FLEXIBILITY in operation from 30% of capacity to more than rated capacity without "blanking off" or other operations that consume time and labor.

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MEXICO	HOLLAND	IRAN
CUBA	FRANCE	INDIA
TRINIDAD	SPAIN	SUMATRA
CURACAO, N.W.I.	ITALY	BORNEO
ARGENTINA	TURKEY	AUSTRALIA
BRAZIL	EGYPT	CHINA
CHILE		JAPAN

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TABLE 6

Commercial Fertilizers Consumed in the United States for Direct Use on the Land

Year Ended June 30, 1950[1]

Tons

Commodity	Quantity	Commodity	Quantity
Mixtures		Ammoniated superphosphate	1,681
N-P-K grades	11,197,502	Basic lime phosphate	3,473
N-P grades	178,471	Basic slag	287,419
P-K grades	831,220	Bonemeal, raw	6,791
N-K grades	73,849	Bonemeal, steamed	5,679
K grades	27,890	Calcium metaphosphate	10,343
		Calcium magnesium phosphate, fused	5,034
Chemical nitrogen materials		Fused tricalcium phosphate	15,598
Ammonia - anhydrous	85,516	Phosphoric acid	6,900
Ammonia - aqua	10,560	Phosphate rock	728,533
Ammonium nitrate	577,562	Colloidal phosphate	20,720
Ammonium nitrate-limestone mixtures	102,205	Precipitated bone	460
Ammonium nitrate solutions	11,108	Superphosphate, 18%-20% P_2O_5	1,856,777
Ammonium sulfate	234,664	Superphosphate, 29%-50% P_2O_5	265,155
Calcium cyanamide	81,578	Other phosphates	1,186
Calcium nitrate	22,156		
Sodium nitrate	627,424	**Potash**	
Urea	18,339	Cotton hull ash	1,671
Other chemical nitrogen materials	14,792	Manure salts, 22%-30%	18,775
		Muriates, 50% and 60%	109,289
Organics		Carbonates	69
Bat guano	339	Magnesia sulfates	5,300
Blood, dried	1,299	Nitrates	8,536
Castor pomace	10,428	Polysulfides	95
Compost	2,277	Phosphate ash	2,430
Cottonseed meal[2]	13,296	Sodium nitrates	2,094
Fish scrap and meal	2,367	Solutions	106
Hoof and horn meal	164	Sulfates	13,902
Linseed meal	925	Tobacco stems	308
Manures, dried	165,219	Wood ashes	5,276
Peat[2]	60	Other potash materials	1,148
Peanut meal	81		
Sewage sludge, activated	61,791	**Minor and secondary elements**[2]	
Sewage sludge, other	27,740	Aluminum sulfate	30
Soybean meal	170	Borax	1,913
Tankage, animal	1,523	Copper sulfate	287
Tankage, garbage	1,406	Land plaster (gypsum)	394,372
Tankage, process	2,751	Magnesium sulfate	173
Tung pomace	116	Manganese sulfate	363
Other organics	1,231	Soil sulfur, 25%-99+% S	22,208
		Sulfuric acid, 40%-93%	4,825
Phosphates		Zinc sulfate	82
Ammonium phosphate, 11-48	19,935	Minerals not segregated	15,254
Ammonium phosphate, 16-20	121,640		
Ammonium phosphate, 13-39	887	Total	18,354,636

1/ Includes distribution in the Territories and by Government agencies. Does not include shipments of materials for manufacture of commercial mixtures.

2/ Excludes similar materials distributed by other than manufacturers of commercial fertilizers.

TABLE 7

Consumption of Plant Nutrients, by States and Regions,

Year Ended June 30, 1950[1]

Tons

State & Region	In Mixtures					In All Fertilizers				
	Nitrogen	Phosphoric Oxide		Potash	Total N, Available P_2O_5 & K_2O	Nitrogen	Phosphoric Oxide		Potash	Total N, Available P_2O_5 & K_2O
		Available	Total				Available[2]	Total		
Maine	11,658	22,515	23,189	26,107	60,280	12,118	26,025	26,800	26,138	64,281
New Hampshire	625	2,187	2,270	2,137	4,949	788	4,392	4,575	2,260	7,440
Vermont	975	4,679	4,799	4,625	10,279	1,088	11,116	11,533	4,873	17,077
Massachusetts	3,633	6,774	7,203	6,284	16,691	4,526	9,195	9,817	6,670	20,391
Rhode Island	718	1,468	1,534	1,561	3,747	816	1,941	2,025	1,627	4,384
Connecticut	3,002	4,968	5,322	4,942	12,912	4,502	8,017	8,579	6,524	19,043
New England	20,611	42,591	44,317	45,656	108,858	23,838	60,686	63,329	48,092	132,615
New York	20,749	47,818	49,831	33,574	102,141	23,913	81,888	85,383	34,063	139,854
New Jersey	9,868	22,838	23,623	20,131	52,837	11,115	25,189	26,084	20,844	57,128
Pennsylvania	19,281	64,399	67,733	40,879	124,559	20,611	83,820	88,842	41,332	145,763
Delaware	1,866	6,256	6,597	4,757	12,879	2,131	6,657	7,028	4,770	13,558
District of Columbia	80	127	142	126	333	109	172	186	133	414
Maryland	7,957	25,890	27,166	17,351	50,898	8,921	30,258	32,071	17,474	56,651
West Virginia	1,931	7,610	8,198	4,431	13,972	2,265	17,542	18,553	4,457	24,264
Middle Atlantic	61,732	174,638	183,290	121,249	367,619	69,065	245,504	258,147	123,063	437,632
Virginia	18,060	63,432	67,803	45,565	127,057	26,522	83,391	88,260	45,967	155,880
North Carolina	49,417	137,600	148,172	104,208	291,225	93,873	149,461	160,493	110,100	353,434
South Carolina	23,161	60,645	65,406	43,495	127,201	52,770	78,744	81,358	50,793	179,307
Georgia	35,385	78,609	85,503	55,421	169,415	60,117	99,998	107,781	60,937	221,052
Florida	35,406	57,186	63,365	56,953	149,545	42,110	61,899	71,780	62,732	166,741
South Atlantic	161,429	397,372	430,249	305,642	864,443	275,392	470,493	509,672	330,529	1,076,414
Ohio	23,600	107,770	114,254	80,170	211,540	27,622	115,358	124,570	80,383	223,363
Indiana	19,000	88,989	94,775	80,364	188,353	26,365	97,290	113,772	81,408	205,063
Illinois	10,104	39,135	41,783	39,281	88,520	16,278	64,620	198,506	49,584	130,482
Michigan	10,440	56,865	61,282	41,895	109,200	13,477	66,403	71,878	42,198	122,078
Wisconsin	8,100	47,316	50,607	43,918	99,334	10,767	52,811	59,240	44,967	108,545
East North Central	71,244	340,075	362,699	285,628	696,947	94,509	396,482	567,966	298,540	789,531
Minnesota	4,306	27,445	28,981	18,849	50,600	5,853	46,198	49,377	18,981	71,032
Iowa	7,176	28,859	31,884	14,270	50,305	13,755	52,996	63,998	15,059	81,810
Missouri	9,531	35,278	38,105	21,717	66,526	18,686	49,426	74,253	23,170	91,282
North Dakota	434	2,838	2,982	1,205	4,477	604	5,116	5,394	1,205	6,925
South Dakota	136	420	485	35	591	335	1,033	1,189	38	1,403
Nebraska	784	1,967	2,044	138	2,889	8,578	5,286	5,676	193	14,057
Kansas	3,063	7,984	8,358	1,286	12,333	11,991	32,575	40,944	1,324	45,890
West North Central	25,430	104,791	112,819	57,500	187,721	59,802	192,630	240,801	59,967	312,399
Kentucky	13,051	35,982	41,769	28,661	77,694	20,566	72,085	86,276	30,497	123,148
Tennessee	12,617	34,722	38,676	24,053	71,392	25,963	61,063	66,776	26,170	113,186
Alabama	32,003	73,732	82,721	50,130	155,865	59,236	108,177	120,417	53,545	220,958
Mississippi	15,001	26,248	29,487	16,934	58,183	87,112	47,226	52,691	24,996	159,334
East South Central	72,672	170,684	192,653	119,778	363,134	192,877	288,541	326,160	135,208	616,626
Arkansas	7,260	15,018	15,442	14,857	37,135	33,728	30,866	31,762	20,485	85,079
Louisiana	7,889	16,410	16,845	9,824	34,123	29,353	24,282	27,370	12,434	66,069
Oklahoma	2,645	7,226	7,662	2,724	12,595	4,262	18,854	28,408	2,866	25,982
Texas	11,200	29,056	30,989	13,465	53,721	27,337	87,044	95,236	13,948	128,329
West South Central	28,994	67,710	70,938	40,870	137,574	94,680	161,046	182,776	49,733	306,459
Montana	203	416	458	48	667	267	3,950	4,261	50	4,267
Idaho	739	1,108	1,196	196	2,041	3,824	9,568	9,956	232	13,624
Wyoming	445	330	346	46	521	265	1,863	1,921	80	2,178
Colorado	1,672	3,303	3,432	1,021	5,996	3,416	9,048	9,299	1,282	13,746
New Mexico	47	92	98	36	175	2,631	4,761	4,853	61	7,473
Arizona	1,805	2,658	2,805	265	4,728	10,245	7,010	7,256	467	17,722
Utah	204	359	369	64	627	1,481	2,831	3,050	90	4,372
Nevada	25	46	47	11	82	26	224	236	12	262
Mountain	4,840	8,310	8,750	1,687	14,837	22,125	39,275	40,832	2,244	63,644
Washington	1,638	2,977	3,225	2,547	7,162	7,697	9,047	10,411	4,147	20,891
Oregon	1,807	3,496	3,726	2,273	7,575	11,778	11,924	12,572	3,389	27,091
California	16,612	16,370	17,251	8,791	41,773	103,876	64,247	56,354	14,978	173,101
Pacific	20,057	22,842	24,202	13,611	56,510	123,351	75,218	79,337	22,514	221,083
Continental U. S.	467,009	1,329,013	1,429,917	991,621	2,787,643	955,639	1,929,875	2,269,020	1,069,890	3,955,404
Hawaii	4,662	3,196	3,385	6,148	14,006	20,412	7,556	7,987	12,726	40,693
Puerto Rico	23,689	13,703	14,457	22,035	59,427	29,401	13,954	14,715	22,077	66,432
Territories	28,351	16,899	17,842	28,183	73,433	49,813	21,510	22,702	34,802	106,125
Totals: 1949-50	496,360	1,345,912	1,447,759	1,019,804	2,861,076	1,005,452	1,951,385	2,291,722	1,104,692	4,061,529
1948-49	512,474	1,384,669	1,500,030	999,035	2,896,178	919,946	1,941,709	2,289,631	1,073,073	3,934,728
1947-48	493,281	1,307,691	1,397,699	872,899	2,673,871	856,719	1,853,639	2,189,892	920,725	3,631,088

1/ Includes Government distribution.

2/ Includes 2 percent of the colloidal phosphate and 3 percent of the phosphate rock marketed for direct application.

to 6,045,704 tons. Shipments were less in North Carolina, South Carolina, Illinois, Minnesota, and 12 other States. Notably increased usage, however, was indicated by larger shipments in all the other States, but principally in the States in the South Central Regions, in the Mountain Region excepting Arizona, and in the Territories. Total shipments of separate materials increased 343,325 tons or 6.0 percent more than in 1948-49.

Shipments of ammonium nitrate increased from 347,223 tons to 577,562 tons. Increases were very noticeable in all States but seven. Most of these were in the North Central Region. Distribution of sodium nitrate decreased in all States but 10. The use of anhydrous ammonia amounted to 85,516 tons as compared with 65,596 tons in 1948-49.

Although there was a general increase in shipments of organics, shipments in all the Southeastern States were less than for the previous year. Shipments in these States amounted to 17,949 tons compared with 21,077 tons for 1948-49.

The total distribution of phosphate rock was only a little more than in 1948-49. Shipments in Illinois decreased from 509,371 tons to 452,608 tons, whereas distribution in Missouri increased from 44,192 tons to 75,372 tons, in Kansas, from 8,522 tons to 25,961 tons, and in Oklahoma from 19,153 tons to 30,162 tons. The use of normal superphosphate decreased in nearly all States of the West North Central and Mountain regions, but the increased distribution of concentrated superphosphate in these States more than made-up for the decrease of normal superphosphate. Total distribution of miscellaneous phosphates decreased in the South Atlantic and West South Central Region but increased in the Middle Atlantic and in the East South Central Region. Total distribution, therefore, was about the same as for 1948-49.

The total consumption of potash salts was only a little less in 1949-50 than in 1948-49. Muriate of potash was more widely used than the manure salts. The total distribution of muriate of potash increased from 95,103 tons to 109,289 tons, which was nearly double the amount distributed in 1947-48. Distribution increased in all of the Regions and in the Territories except Regions along the Atlantic Coast. The total distribution of miscellaneous potash materials was but 59,610 tons compared with 80,504 tons in 1948-49; due primarily to a decrease in shipments of manure salts from 48,765 tons to 18,775 tons. In the Atlantic Coast Region and in the Territories distribution of manure salts was only a little less than in the previous year, but distribution in all the other Regions was about one-half of the tonnage as compared with 1948-49.

The distribution of minor and secondary element materials decreased from 509,565 to 439,507 tons, as the result of less distribution of gypsum, which was only 394,372 tons compared with 461,638 tons in 1948-49.

Plant-Nutrients

Commercial fertilizers supplied to United States agriculture 4,061,529 tons of nutrients in the year ended June 30, 1950. This consisted of 1,005,452 tons of nitrogen, 1,951,385 tons of available phosphoric oxide (P_2O_5) (total phosphoric oxide was 2,291,722 tons), and 1,104,692 tons of potash (K_2O). The tonnages consumed in each State are in Table 7. The 1949-50 figures for N, available P_2O_5, and K_2O are 9.3, 0.5, and 2.9 percent larger, respectively, than those for 1948-49; and 17.4, 5.3, and 20.0 percent larger than for 1947-48.

The tonnage of commercial mixtures in 1949-50 was 530,574 tons or 4.1 percent less than for 1948-49. The nutrients supplied in 1949-50, however, were 35,102 tons or 1.2 percent less than for 1948-49. This was due to the more general use of higher analysis mixtures in 1949-50.

Shipments of separate materials that contained N, P_2O_5 or K_2O were 413,383 tons more than for 1948-49. Total nutrients supplied by all separate materials were 1,200,453 tons, an increase of 161,903 tons over the 1948-49 figure. The additional nutrients supplied by the larger tonnage of separate materials together with the use of higher analyses mixtures and materials resulted in a net increase of three percent more nutrients than for 1948-49, although the tonnage of all fertilizer shipments was one percent less.

WE MEANT 1950, OF COURSE

On page 46 of the May issue we had a box concerning "1951" fertilizer consumption totals. We meant 1950, of course.

PITTSBURGH BUYS SOUTHERN ALKALI SHARES

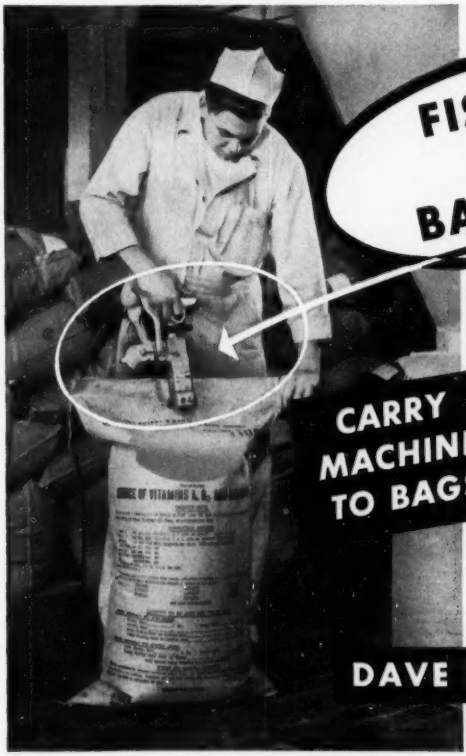
Pittsburgh Plate Glass Company's executive committee authorized the purchase of American Cyanamid's 49 percent stock interest in Southern Alkali Corporation. Pittsburgh previously owned 51 percent of the stock of Southern Alkali. The purchase price for American Cyanamid's interest was approximately $19,000,000, according to the firm.

Southern Alkali has been operated by Pittsburgh Plate Glass Company since Southern's incorporation.

E. T. Asplundh who has been named president of Southern Alkali, has been associated with Pittsburgh Plate Glass Company's chemical operations since 1919. He has served as vice president in charge of Pittsburgh's Columbia Chemical Division since 1940 and as vice president of Southern Alkali Corporation since 1944.

Clarence M. Brown, board chairman of Pittsburgh Plate Glass Company since 1931 and a member of Southern Alkali's board of directors since the subsidiary's incorporation in that year, has been named chairman of Southern's board of directors, a newly created position.

Pittsburgh Plate has transferred its Columbia Chemical Division to Southern Alkali which now operates chlorine, alkali and related chemical producing plants at Corpus Christi, Texas, Barberton, Ohio, Natrium, West Virginia, Lake Charles, Louisiana and Bartlett, California.



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- **Handles all types of textile bags and a wide variety of paper bags.**

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DEPT. 3D

38 GLENWOOD AVENUE
MINNEAPOLIS 3, MINNESOTA

MARKETS

ORGANICS: Fertilizer organics are in firm market position with offerings limited. Current domestic Nitrogenous tonkages are $4.60 to $6.00 per unit ammonia in bulk fob production points. Imported Nitrogenous offerings are extremely light at around $6.25 per unit Ammonia, in bags, for summer and fall arrival CIF Atlantic ports. South American organics are too high for most domestic fertilizer manufacturers to buy.

CASTOR POMACE: Recently sales have been made at $5.50 per unit Ammonia in bags FOB Northeastern production points for May shipment, and limited quantities for June and July shipment. Some of the June shipment is priced on the old flat ton basis of $37.25 in burlaps or $35.25 in paper bags/seller's option. The flat ton price is for minimum 6.75% Ammonia.

DRIED GROUND BLOOD: This market is dull at around $7.75/$8.00 per unit ammonia, bulk, Chicago area. New York Market is around $8.00/$8.50.

POTASH: Demand continues steady with supplies short in some areas. Shipments have not been recently interrupted by car shortages.

GROUND COTTON BUR ASH: Movement of this excellent source of Carbonate of Potash has been steady from some Texas sources. Availability of supplies depends on shipment desired. Material from reliable sources is analyzing rather consistently around 40% K_2O Potash.

PHOSPHATE ROCK: This market is firm with movements steady against contracts. Supplies of high grade and low grade rock are reported in limited quantity above ground at the mines.

SUPERPHOSPHATE: Supply continues short of demand, particularly in the Midwest and west. This is particularly true of Triple Superphosphate. Contracting for future shipment is in the doldrums until ceiling prices have been established.

SULPHATE OF AMMONIA: Coke-oven material is in tight supply position still although it is reported some spot material moved recently at $40.00 per ton FOB Steel Mill.

AMMONIA NITRATE: Supply and demand are still out of balance. Prices remain firm and unchanged but production still cannot meet the overall call.

NITRATE OF SODA: Prices continue unchanged with demand steady and slightly greater than supply.

GENERAL: The three major fertilizer ingredients, Nitrogen, Potash, and Superphosphate continue in strong demand although business in the lower Southeast is tapering off. Superphosphate and Potash remain the greatest in demand in the Midwest and West.

FERTILIZER TAX TAG SALES AND REPORTED SHIPMENTS1/
(In Equivalent Short Tons)
Compiled by The National Fertilizer Association

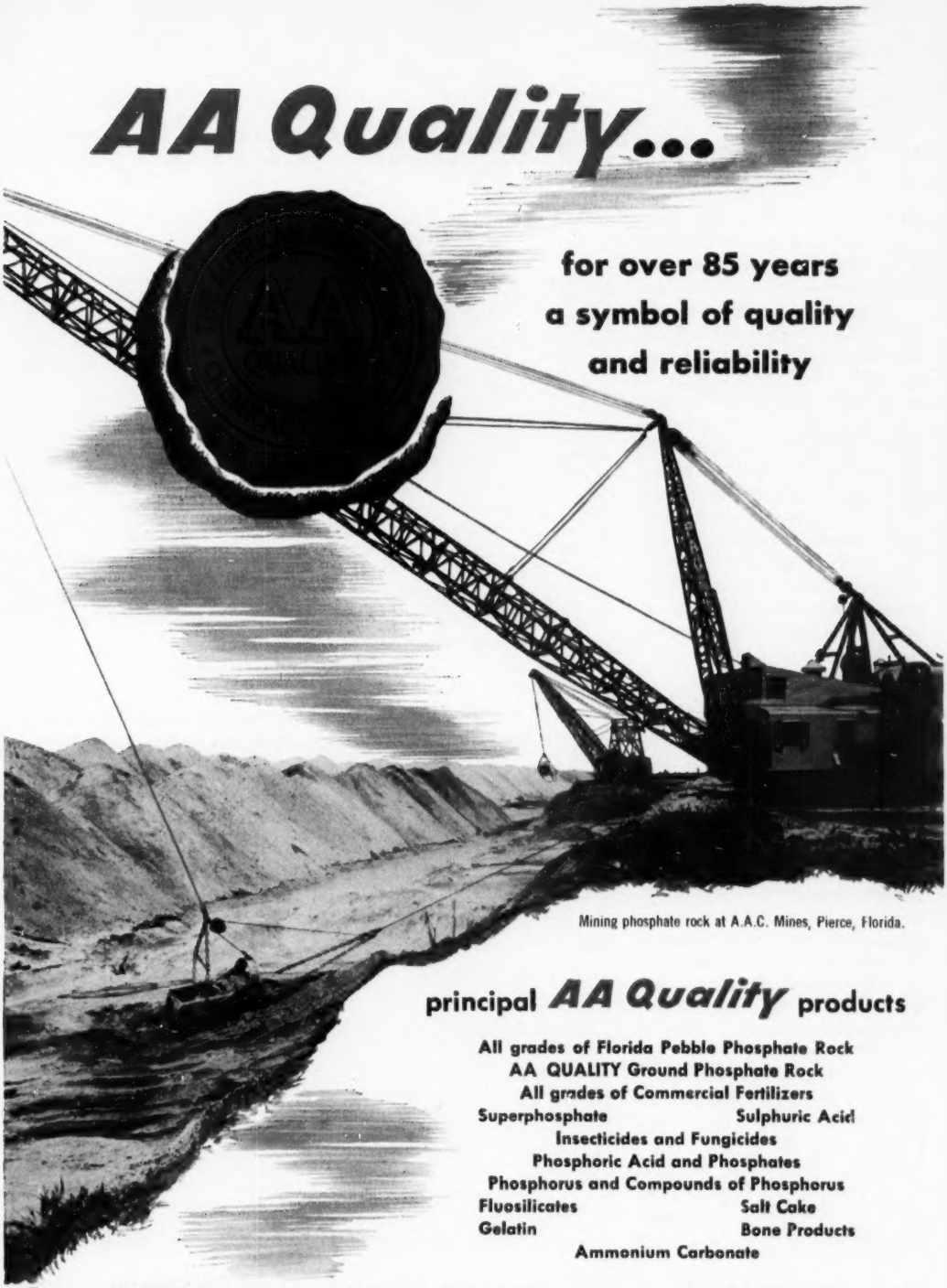
STATE	April		January-March		July-March	
	1951	1950	1951	1950	1950-51	1949-50
Virginia	1/	1/	295,628	306,552	454,176	494,980
N. Carolina	1/	1/	932,624	910,697	1,323,909	1,168,268
S. Carolina	110,564	101,798	527,975	546,628	836,186	746,772
Georgia	164,655	194,697	722,783	690,198	1,002,236	907,411
Florida	93,545	73,611	373,934	346,509	901,154	815,138
Alabama	220,313	228,694	386,143	348,278	613,157	513,795
Tennessee	92,060	104,611	134,091	100,283	253,609	201,326
Arkansas	98,599	81,489	135,536	98,191	211,469	165,609
Louisiana	47,058	48,327	148,997	117,217	223,224	173,661
Texas	59,471	61,331	215,402	201,961	471,511	417,610
Oklahoma	1/	1/	57,484	60,290	113,092	114,808
TOTAL SOUTH	886,265	894,558	3,930,597	3,726,804	6,403,723	5,719,378
Indiana	89,465	74,950	275,205	296,924	771,369	702,343
Kentucky	55,038	92,073	231,988	254,304	439,751	420,351
Missouri	57,520	52,387	316,176	218,735	579,356	386,719
TOTAL MIDWEST	202,023	219,410	823,369	769,963	1,790,476	1,509,413
GRAND TOTAL	1,088,288	1,113,968	4,753,966	4,496,767	8,194,199	7,228,791

1/ Oklahoma and North Carolina report tax tag sales 30 days after the end of the current month. Oklahoma and North Carolina tag sales for March 1951 represent 29,573 and 317,516 tons respectively, compared to 30,456 and 302,274 tons during March 1950. Virginia reports quarterly.

U. S. SUPERPHOSPHATE SUMMARIES, in Thousands of Short Tons
Based on Data for 204 Plants, Representing Total U. S. Production
Compiled from Reports Submitted to The National Fertilizer Association and A Summary of Reports Submitted to the Bureau of the Census.

	March, 1951			Total, 18% APA Basis				Conc. (45% APA)	
	Normal 18% APA Basis	Wet Base 18% APA Basis	Conc. 45% APA Basis	March		Jan.-Mar.		Jan.-Mar.	
				1951	1950	1951	1950	1951	1950
Stocks, first of period	952	16.8	62	1,124	1,311	1,207	1,421	55	104
Production	924	8.1	67	1,099	1,086	3,053	2,746	188	172
Received from other plants	12	0	0	12	11	38	34	0	0
Book adjustments	—2	0	0	—2	10	4	22	0	0
Total Supply	1,886	24.9	129	2,233	2,418	4,302	4,223	243	276
Shipments	565	10.0	59	723	855	1,880	1,943	172	201
Used in reporting plants	559	2,4	2	565	551	1,477	1,267	3	5
Total disposition	1,124	12.4	61	1,288	1,406	3,357	3,210	175	206
Stocks, end of period	762	12.5	68	945	1,012	945	1,012	68	70

AA Quality...



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AA QUALITY Ground Phosphate Rock
All grades of Commercial Fertilizers
Superphosphate — Sulphuric Acid
Insecticides and Fungicides
Phosphoric Acid and Phosphates
Phosphorus and Compounds of Phosphorus
Fluosilicates — Salt Cake
Gelatin — Bone Products
Ammonium Carbonate

The AMERICAN AGRICULTURAL CHEMICAL Co.

GENERAL OFFICE: 50 CHURCH STREET, NEW YORK 7, N. Y.

31 FACTORIES AND SALES OFFICES, SERVING U.S., CANADA AND CUBA—ASSURE DEPENDABLE SERVICE

Starter Fertilizers

By Wm. A. Albrecht

Department of Soils College of Agriculture
University of Missouri

There are two major factors in getting a crop off to a good start, namely, the seed and the soil. The careful selection of the seed, its purity, proper storage, its correct labelling, the germination test of it, and all the other cautions exercised by the seedsmen have so standardized the seed that irregularities in the germination, the emergence, and the stand can no longer be charged against this factor of crop production. As for the soil, however, equally as much guarantee by it for the future crop cannot always be claimed. The necessary nutritional helps from the soil fertility are not always available early enough in the seedling's life. For improvement of this the fertilizers have been drilled with the crop seedings. They have been **starter fertilizers.**

Soils fertile naturally or by treatments give higher percentage of emerging seedlings from planted seeds

That such use of plant nutrients is a good practice has been shown by accurate counts of young plants to find the larger percentage of the emerging planted seeds as seedlings on soils of higher fertility. Better stands from less seed occur as the soils are naturally more fertile or are made so by fertilizer treatments. The crop "takes" the fertile land over.

Our waste of seed has become more serious as the fertility of the soil has been declining. That we should scatter two million red clover seeds per acre of 43,560 square feet shows the foolhardiness of expecting those 45 seeds per square foot to make 45 plants on that little area. Is it not wise to ask ourselves why no more than four or five plants result in spite of that large number of seeds thrown there? Careful tests of increasing rates of seeding demonstrated decreasing percentages of emergence of seeds planted. That percentage drops more rapidly on the soils of less fertility than on those more fertile. Getting the crop off to a good start on many soils calls for starter fertilizers as a seed-saver and a stand-getter.

"One has no trouble getting a stand of weeds" farmers commonly tell us. But when weeds don't make much that is nutrition they don't go very far in food production and don't need much to arrive there. But when seeds are very small, like those of alfalfa and red clover, and when the crops are generous producers of proteins, there is too little initial reserve in the seed to carry the seedling very far along its course of growth. It must "root" into the soil right soon, which every seed does before its shoot goes up for sunshine. Even a seedling looks to the soil first and to the weather second. Weeds, as crops that don't make enough to tempt a cow, can get themselves up right soon to use sunshine, water and air. They can make good stands on their little of needed fertility that can be provided by most any soil.

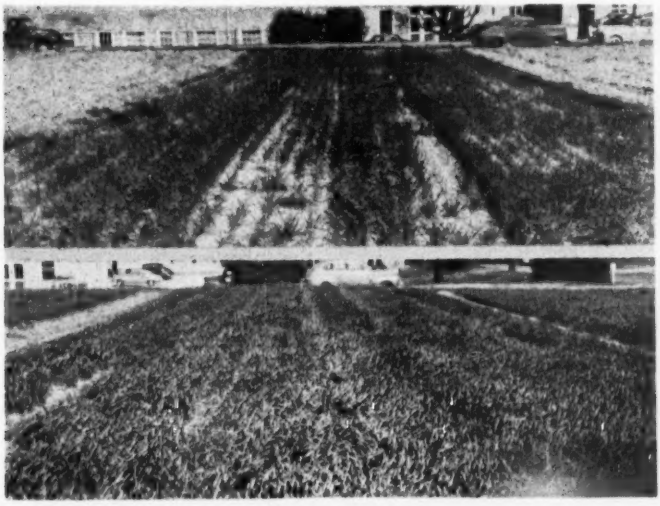
Starter fertilizers militated against heavier applications of themselves until better placement resulted

Putting the fertilizers right with the seed has long been the more common procedure in their application. On our virgin soils, this method nursed the young plants until their roots moved down into the subsoil, much of which was of glacially mixed origin and fertile enough to be **sustaining fertility** for the remainder of the season's growth of the plants. Satisfactory crop yields then were not so large. A single crop was not so highly exhaustive of the soil. The decay of the virgin organic matter was an active process bringing release of much carbonic acid. This was active in decomposing the silt mineral reserves. Their nutrients were restocking the soil's colloidal complex and making up for the small amounts of fertility the lower crop yields had removed. Surface soils given starter fertilizers, and deeper soils over subsoils containing much natural sustaining fertility left most of us unmindful of the fact that fertilizers were really not growing the crop completely.

Improper and excessive credit

and Sustaining Fertility

No treatment (above) in contrast to six tons manure annually (below) tell us that manure has been the sustaining fertility during sixty-two years of continuous wheat, when the plot with no treatment ceased to pay its costs long ago. Sanborn Field, Missouri Agricultural Experiment Station.



Manure at three tons per acre (above) in contrast to nitrogen, phosphorus and potassium in fertilizers equivalent to a forty bushel crop (below), tell us that the starter fertilizers have also been sustaining fertility for sixty-two years of continuous wheat. Sanborn Field, Missouri Agricultural Experiment Station.

to fertilizers was a common mistake because their functions in the plant, and their behaviors in the soil, had not been understood in terms of the chemical and biochemical reactions involved. The fallacious belief that fertilizers had to be water soluble, and that they served the plant because they remained in solution in the soil, has been finally displaced. Those concepts were pushed out by our knowledge of the fact that soluble cations are absorbed on the soil's colloidal complex. Therewith they are no longer water soluble. After a day or two in soil contact they cannot be washed out from there by water. Placed with the seeding as a starter fertilizer they are, nevertheless, taken quickly by the plant for its early stimulation to better growth.

Deeper placement made starter fertilizers become sustaining fertility too

Were not the soluble starter fertilizers quickly absorbed on the soil to become insoluble, they would "salt out" the young seedlings. Fortunately in this respect, the superphosphate carrying much calcium has been a protector since much of it goes into the fertilizer mixtures carrying the dangerous salts of nitrogen and potash. Calcium salts are not so damaging as those of the other elements. Because of the ever-present dan-

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Deep Placement* of Fertilizer on Potash-Deficient Soil is "Sustaining Fertility" Throughout Rotation.

Fertilizer	1946 Corn bu./A	1947 Corn bu./A	1948 Soybeans bu./A	1949 Wheat bu./A	1950 Red Clover lbs./A
8-8-8	75.1	72.6	31.5	29.0	3650
8-8-0	60.0	60.5	31.0	26.5	3290
0-8-8	65.5	61.6	33.0	23.8	3750

*Fertilizers were placed behind the TNT subsoiler at 1500 lbs. per acre of 8-8-8 and the others at the corresponding nutrient equivalent. Differences in potash effect were still apparent in the clover crop five years after the placement.

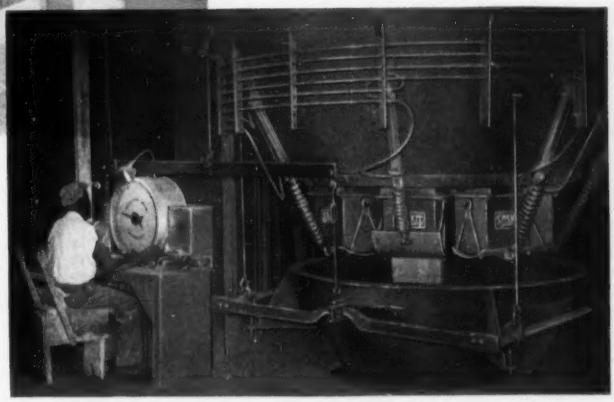
ger from salt injury and damage to the stand, starter fertilizers in seed contact have always been used in limited amounts. In larger amounts they offered trouble rather than hope when at the same time the declining soil fertility was calling for heavier applications to make up the difference which would have been better business for the fertilizer distributor as well as for the farmer.

The placement of the starter fertilizers in a soil position other than seed contact was an evolutionary step of more importance than either the farmer or the fertilizer producers anticipated. For the latter it meant heavier applications without danger of seed injury, thereby more and bigger sales of fertilizers. For the former it meant bigger and more nutritious crops with less risk of stand loss. It was going forward on a sounder principle in plant nutrition. It was allowing the root to move toward the fertilized soil volume and into the specific concentration there of most effective nutritional service for the root. It was no longer a case of immersion of the seedling into a "salty" environment. It was offering nourishment later in the plant's growth, after the seed reserves were dwindling, and when the roots were moving down into soil horizons more regularly of good moisture content. Placement of fertilizers at greater depths was more wise than originally expected, since the ordinary plow served soon to put the fertilizers down with greater effectiveness resulting. It burried greater quantities of them than had ever been used before. It moved fertilizer use on where little had been used before. Other factors soon added their force to push the curve of fertilizer consumption upward at a sharp angle and one not yet stabilized in that respect at this date.

Deeper placement of much larger amounts of fertilizers in the soil has allowed them to take on the added services of becoming sustaining soil fertility as well as being starter fertilizers. Heavier applications in the limited but deeper soil zones are no longer feared. Rates as high as 1500 pounds of 8-8-8 per acre put down behind the subsoilers of an Oliver TNT plow in experimental trials have been anything but damage. As sustaining fertility, such rates bid fair to carry their visible effects from the initial application through the entire six-year rotation. Their effects on the yields are a matter of simple record. Their higher nutritional values can be demonstrated by animal choice. As our knowledge of the fundamental

IS THIS YOUR PLANT?

Obsolete batching methods formerly used in this plant accounted for the congestion and gross waste of man power shown by this unposed photograph.



THIS SACKETT ONE MAN BATCH-WEIGH SYSTEM

Cut operation costs 65%

In the plant pictured here, production cost tumbled 65% when the Sackett System replaced obsolete method formerly used.

CHALLENGE US TO DO AS WELL FOR YOU

You can be sure the estimated cost savings included with Sackett's Survey of your production operations will be met . . . or exceeded.

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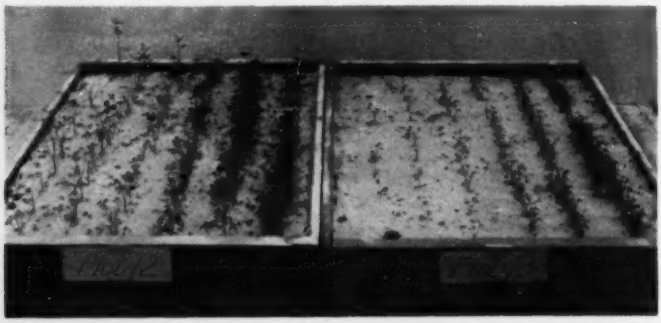
Architects and Manufacturing Engineers to the Fertilizer Industry since 1897

Better stands of alfalfa from less seed are "natural" on more fertile soils. Increasing rates of seeding (left to right) give decreasing percentage of emergence, and stand, but more so on poorer soil. Sanborn Field, Plot 12, Limestone and manure, Plot 13, No treatment. (White sand cover)



principles of plant nutrition developed and our concepts moved away from those of solution to those of the soil's adsorption and exchange of the fertility elements, the use of fertilizers has now become an activity in truly nourishing the crops.

Sustaining fertility must become the prevention of soil erosion

Because soil erosion has reached the dimension of disaster, we have become conscious of the weakness of the soil body under falling rain water. While terraces are a means of reducing the rate of water runoff, they are not a means of restoring the internal strength for granula-

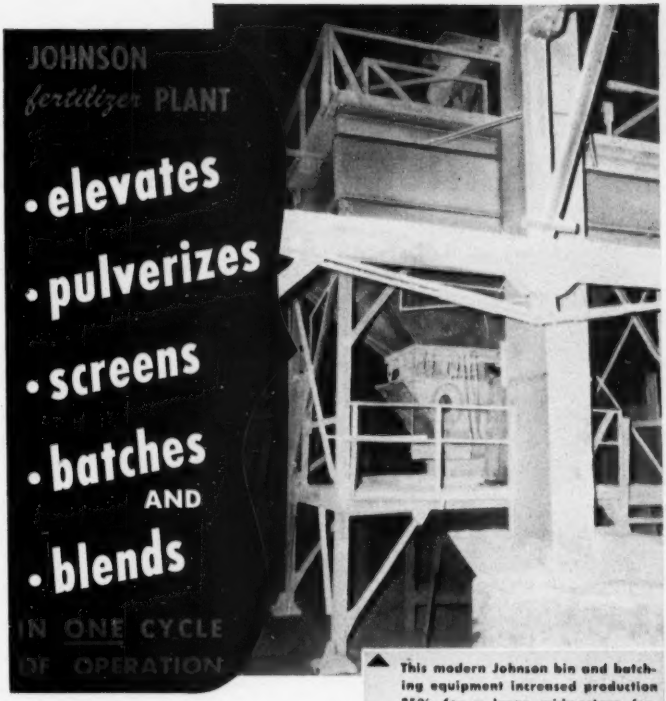
Farm manure and virgin organic matter have been the sustaining fertility (for the winter cover of weeds as well as the corn crop) and the shock absorber for fertilizer misuse. Sanborn Field, Missouri Agricultural Experiment Station. Left—no treatment. Right—6 tons manure annually (since 1888.)

Starter fertilizer below (left) gave neither a good stand nor the growth of corn to keep the weeds out as was the result from (right) starter fertilizer after the heavy treatment of sustaining fertility had been plowed under. (Poirot Farms, Golden City, Mo.)

tion or the stability of good structure by which rainwater goes into the soil in place of sealing off its surface. Terraces may be likened to the splints holding in place the broken bones of a limb. Splints cannot provoke the physiological functions by which the break in the bone is healed. The healing of the broken soil body comes through restoration of the fertility, the internal strength of it, by which the crop cover grows rapidly, the organic matter is increased, and the granular structure is restored to a stability much beyond that so readily broken down by the impacts of the falling raindrop. We are slowly realizing that there is no longer much natural sustaining fertility left in many cultivated soils. Where not so long ago it was estimated that 20 percent of our crop production resulted from starter fertilizers and 80 percent from natural sustaining fertility, now the soils of lowered fertility coupled with ambitions and necessities for hundred bushel crops make a larger share of that crop yield come from applied fertility. There is the call to cover both the decline in sustaining fertility and the greater need for starter fertilizers by soil treatments of extra plant nutrients.

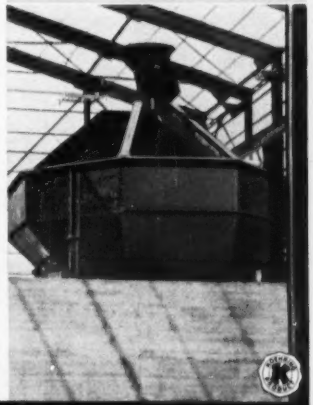
These facts are crowding the issue right up before us as to whether we dare neglect the fertility of the soil and expect the mechanical obstructions against running water to remedy the troubles associated with erosion. The fertility call is one for not only heavier applications of the three elements, nitrogen, phosphorus, and potassium com-

(Continued on page 72)



▲ This modern Johnson bin and batching equipment increased production 25% for a large midwestern fertilizer manufacturer . . . and, at the same time, greatly reducing manpower requirements in the plant.

▼ Photo below, of one of Latin America's most modern fertilizer manufacturing plants, shows hopper, pivoted distributor and 8-section bin of a C. S. Johnson blending plant.



BY eliminating slow, costly manual operations, Johnson fertilizer blending plants profitably increase production output . . . and earn important savings in manpower. For example, on one typical Johnson installation, material travels via bucket elevator to clod breaker, where it is pulverized, then carried on belt conveyor to separating screen.

Collecting hopper under screen feeds the pulverized material to a pivoted distributor which charges a sectional 5-compartment bin. Multiple-material batcher accurately weighs 5 (or more) fine-grained materials and discharges batch into mixing unit for final blending operation.

Whether you are interested in complete plant installations, manual or fully-automatic, or need auxiliary equipment to modernize your present facilities, it will pay you to see your C. S. Johnson Co. distributor . . . or send coupon today for more complete information.

J181

Mail to: C. S. JOHNSON CO. CHAMPAIGN, ILL.
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☐ Send us more data on Johnson fertilizer blending plants. ☐ Have Johnson distributor call.

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Also interested in: ☐ bulk phosphate storage plants ☐ aeration systems ☐ screw conveyors ☐ bucket elevators ☐ bins ☐ hoppers ☐ batchers ☐ clamshell buckets

NATIONAL FERTILIZER ASSOCIATION

26th ANNUAL CONVENTION

June 11-12-13, 1951—THE GREENBRIER—White Sulphur Springs, West Virginia

Sunday, June 10

8:00 P.M.—Meeting of the Executive Committee (in the Washington Room)

Monday, June 11

9:00 A.M.—Registration

10:00 A.M.—Meeting of the Board of Directors (in the Washington and Lee Rooms)

10:00 A.M.—Open meeting of the Plant Food Research Committee (in the Virginia Room)
All those attending the convention are cordially invited. Special presentation by the Corn Subcommittee on the subject, "More Corn for America"

PARTICIPANTS

Chairman: Proctor W. Gull, Agronomist, Spencer Chemical Company
Borden S. Chronister, Chief Agronomist, Southern Division, Barrett Division, Allied Chemical & Dye Corporation
Murry C. McJunkin, Northeastern Agronomist, Coke Oven Ammonia Research Bureau
George V. Taylor, Director of Market Research, Spencer Chemical Company

4:00 to 5:30 P.M.—Garden Party for the ladies (in the Old White Patio)

9:00 P.M.—Meeting of the Nominating Committee (in Washington Room)

Tuesday, June 12

8:00 A.M.—Breakfast of the Plant Food Research Committee (in the Washington and Lee Rooms)

10:00 A.M.—GENERAL MEETING
Auditorium (Ladies invited)
Chairman J. E. Totman presiding
Song: America
Invocation: The Reverend C. D. Denham, First Presbyterian Church, White Sulphur Springs
Annual Convention Address: James E. Totman, Chairman of the Board of Directors
Address: "Number Your Freedoms," Honorable Clinton P. Anderson, U. S. Senator from New Mexico
Report of Nominating Committee: H. B. Fultz, Chairman (Several Directors-at-large and several District Directors are to be elected. If there are nominations from the floor, the ballot box will be open at the registration desk from 1:00 to 5:00 p.m.)
Submittal of the Budget: E. S. Russell, Chairman, Budget Committee

2:00 P.M.—Ladies' Bridge Party (in the Trellis Lobby)

7:30 P.M.—ANNUAL BANQUET—J. E. Totman, Toastmaster (Added charge by hotel for this function and gratuities—$4.20 per person)
Entertainment

Wednesday, June 13

10:00 A.M.—GENERAL MEETING
Auditorium (Ladies invited)
Chairman J. E. Totman presiding
Annual Convention Address: President Russell Coleman
Address: "Inflation is Fun While it Lasts," Edwin G. Nourse, Author and Economist
Address: "Save Our Land," E. J. Condon, Assistant to the President, Sears, Roebuck and Company, and President of Friends of the Land
Unfinished Business
New Business
Memorial Record: Dewey Lange

12:30 P.M.—Adjournment

The annual meeting of the new Board of Directors will be held immediately after adjournment of the convention for the purpose of organizing and transacting any business that may properly come before the Board.

IMPORTANT ANGLE ON FARM PROFITS

Protection is essential to the success of any farm—protection in many and varied forms; some small, some great.

Thus, a few small lashes serve to protect this bull's eye from harm. While the wise and considered use of the right type of fertilizer will serve to protect—and enhance—the very basis on which all farm profits depend: the productivity of the soil.

Many of the most effective of these fertilizers contain potash—often Sunshine State Potash, a product of New Mexico. For potash is not only a soil nutrient, it is a crop strengthener as well. It helps to resist disease and drought, increases output, and improves condition at time of harvest.

Reg. U. S. Pat. Off.
HIGRADE MURIATE OF POTASH
62/63% K_2O
GRANULAR MURIATE OF POTASH
48/52% K_2O MIN.
MANURE SALTS 20% K_2O MIN.

UNITED STATES POTASH COMPANY, *Incorporated*, 30 Rockefeller Plaza, New York 20, N. Y.

NFA RECREATION

Two cocktail parties will be held at White Sulphur Springs during NFA's 26th annual June convention. The organizations which have generously provided for the affairs and have invited everyone attending the meeting to be present are: H. J. Baker & Bros., whose party will be held Monday evening, June 11 at 6 p.m. in the Spring Room and West Terrace; and the International Minerals and Chemical Corporation, whose function will be held at the same hour and place on the following evening.

Monday, June 11

Members' Golf Tournament
Ladies' Putting, Golfers—10:00 a.m.
Ladies' Putting, Non-golfers—2:00 p.m.
Horseshoe Pitching—1:30 p.m.
Ladies' Garden Party—4:00 p.m.
Men's Tennis
Ladies' Tennis
Dancing in the Evening

Tuesday, June 12

Members' Golf Tournament
Veterans' Golf Tournament
Guests' Golf Tournament
Ladies' Golf Tournament (tee off 10:00 a.m.)
Horseshoe Pitching—1:30 p.m.
Men's Tennis
Ladies' Tennis
Ladies' Bridge Party—2:00 p.m.
Dancing in the Evening

Wednesday, June 13

Members' Golf Tournament
Men's Tennis
Ladies' Tennis

NFA CONVENTION COMMITTEES

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George H. Dunklin, Planters Fertilizer & Soybean Company Pine Bluff, Arkansas

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Mrs. W. R. Morgan, care International Minerals & Chemical Corp., 20 North Wacker Drive, Chicago 6, Illinois.

Mrs. Frank Seymour, 411 Park Avenue, Goldsboro, N. C.

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Mrs. James Naftel, Pacific Coast Borax Company, First National Bank Bldg., Auburn, Alabama

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Ladies' Hospitality

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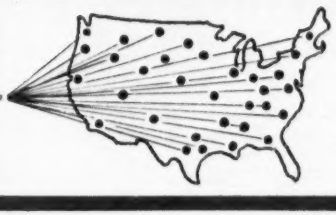

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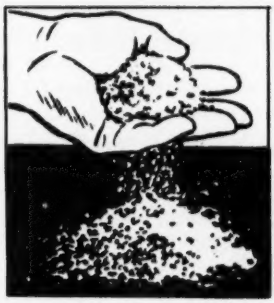

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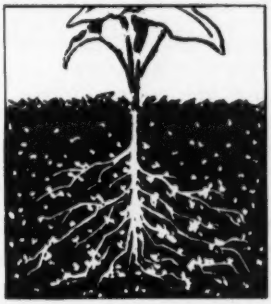

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Sulphur

Industry Developing New Resources and Old Ones

We have published over the past few issues scattered references to what the industry is doing about the sulphur scarcity. Let's put it all together in one place, and see what the future looks like. What has been done and is being done can lead by next year to considerable relief from the present problem. But it will take all of this and more to get us out in the clear, as world needs exist today.

It will take improved waste-acid recovery. It will require better development of the hydrogen sulfide content of various sources such as natural gas, refinery gas, pyrites and pyrrhotite, gypsum, new domes, new and now unworked sulphur deposits.

A lot of that is under way. Costs are high, but the need is great. New Frasch-minable operations are being financed by the Export-Import Bank, hopefully.

Freeport's dome at Bay Ste Elaine, is hard to get at, being in a marsh, and the operation is being built on barges which have to be hauled 75 miles, sunk into position. They are working near Houston, the Nash dome, and are prospecting Dog Lake, Lake Pelto, Venice and the Garden Island bay domes.

Texas Gulf is working the Spindletop dome near Beaumont. Jefferson Lake is nearly ready with a plant at Starks dome. Mexican Gulf Sulphur is steaming up to a capacity of 200,000 tons. The Southern Mexican area has geological structures similar to those in Louisiana and Texas, and these are in the thinking of the industry. And at the other end of the U.S., Alberta Canada has great sulphur beds, being planned for.

Consolidated, Lion, Matheison, Phillips, Shamrock, Stanolind, Richardson, in the U. S. and Guanos Fertilizate de Mexico in that country are all busy on petroleum and natural gas processes.

Pyrites sources in Ontario are being worked with furnaces long since consigned to the dust-heap, but now back in action. Coal operators look with real interest at their "gob" piles to which the Singh process can be applied. Bethlehem Steel is abount to work Pennsylvania pyritic ore areas. General Chemical is mining it in Virginia. Freeport has an option on a tract in the same region.

We have reported on the Chemical Construction process, as applied in the plant building in Colombia, S. A. and the process may be put to work in Wyoming where there are surface deposits.

Meanwhile the British are, as we have reported, building a plant to produce sulphur from anhydrite.

So by next year there will be some help, and in two years conditions can well be improved as to supply. For the time being costs will have to be forgotten.

Economic Advantages of Ammonia From Natural Gas

H. A. Tuttle, Chemical Construction Corporation, 488 Madison Avenue, New York City, in a paper delivered last month at the Midwest Regional Meeting of the American Institute of Chemical Engineers in Kansas City, outlined a method for production of ammonia gas from steam and natural gas which is cheaper than the commonly used process which utilizes coke or coal.

In his paper, the author developed the economic reason for using hydrocarbon gases as a source of material. He discussed thermal cracking briefly, giving reaction rates and pointed out its limitations and disadvantages. He then described the newer catalytic process in detail, giving data on function and design of the main items of equipment.

The use of solid carbonaceous fuel and water vapor has been in the past the more accepted method of obtaining hydrogen, through use of gas producers for gasification of coke or coal with steam. More recently, hydrocarbon gases have been employed in the production of hydrogen for ammonia plants, and the reason for this is purely economic.

To produce the hydrogen necessary for one short ton of ammonia requires approximately 35,000,000 BTU's. Translating this into the cost of raw material or energy, it is equivalent to 10,450 KWH per ton of ammonia using electrolytic process or 1.4 tons of average coke per ton of ammonia or 35,000 cu. ft.

of natural gas per ton of ammonia. With natural gas selling at 20 cents per 1000 cubic feet, coke would have to cost $5.00 per ton and electricity 7/10 mills per KWH to be competitive.

This favorable economic position for natural gas has stimulated the development of processes for the conversion of hydrocarbon gases, chiefly natural gas, into hydrogen.

While the hydrocarbon gases may be processed with oxygen alone to produce hydrogen, the reacting of hydrocarbon gases with steam has the added advantage of obtaining hydrogen both from the reacted gas and the decomposed steam.

Two methods are available for carrying out this latter reaction: 1) the thermal cracking of hydrocarbons in the presence of steam, and 2) the catalytic reforming of hydrocarbon gas with steam.

The thermal cracking of hydrocarbons involves the use of high temperature refractories and processes which have proven costly to build and expensive to operate. For this reason, the catalytic method has become almost universally accepted in reforming hydrogen gas to obtain hydrogen.

Tuttle, in his paper, gave a complete explanation of the chemistry behind the catalytic process, he described the equipment involved including primary and secondary reformers, and he discussed carbon monoxide conversion.

In concluding his paper, Mr. Tuttle said, "From all indications, . . . hydrocarbon gases, as long as they are available, are going to play a steadily increasing role in supplying the source material for ammonia synthesis raw gas. The use of the catalytic process, due to the simplicity of its design and operation, will continue to be the accepted method of processing these gasses into an acceptable gas for the synthesis of ammonia."

Camp V-P of SW Potash

Thomas E. Camp Jr. joined Southwest Potash Corporation, 61 Broadway, New York City, June 1 as Vice President in charge of sales. He was Atlanta Division Manager of Armour Fertilizer Works, and has had many years of experience in the fertilizer industry.

Southwest Potash Corporation, a wholly-owned subsidiary of The American Metal Company, Limited, hopes to begin production in late 1952.

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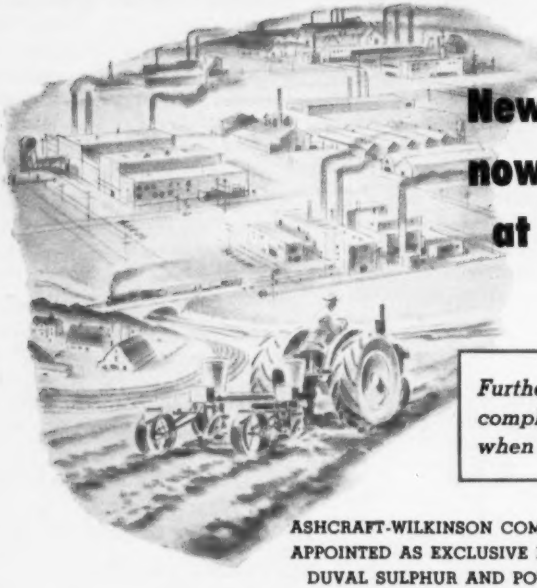

New Plant and Refinery now under construction at Carlsbad, N. Mex.

Further announcement will be made about completion of the Duval Plant and as to when deliveries can be made.

ASHCRAFT-WILKINSON COMPANY HAVE BEEN APPOINTED AS EXCLUSIVE DISTRIBUTORS FOR DUVAL SULPHUR AND POTASH COMPANY

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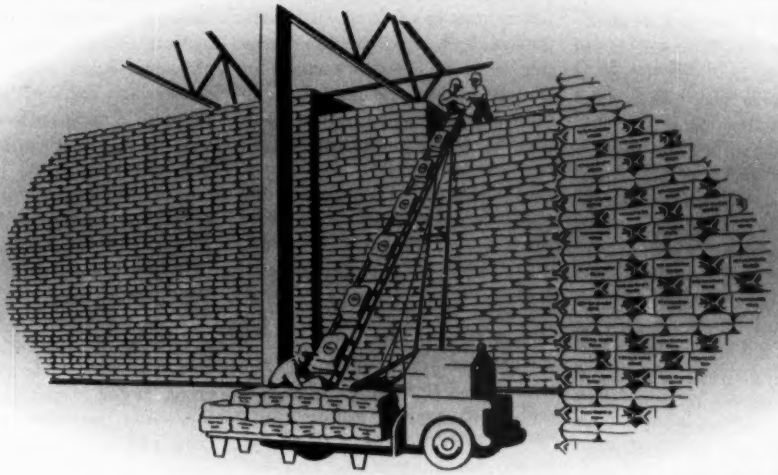

Yes, a great deal more goes into Hammond Multi-Wall Bags than the hundreds of products that are now safely and dependably shipped in them. Here are a few reasons for Hammond's steady growth and for the steadily increasing demand for these Better Bags:

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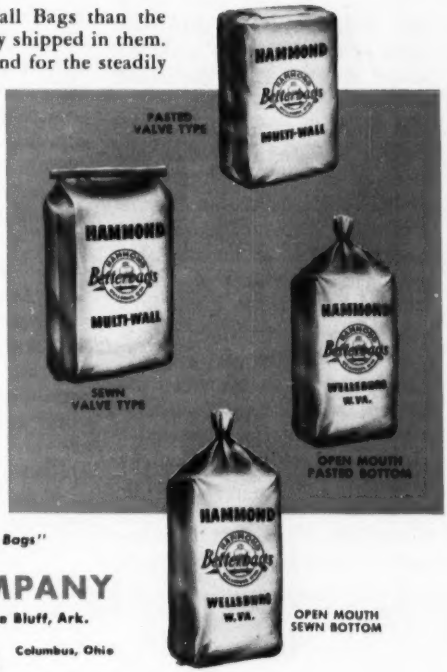

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Mineral elements and Nitrogen in

By JACKSON B. HESTER[1]

Department of Agricultural Research, Campbell Soup Co., Riverton, N. J.

Throughout the ages organic animal manure has been considered by many people to be the most satisfactory for practical purposes and the only substantial source of plant nutrients. There is today a group of "die-hards" which are still maintaining that the only method of maintaining soil fertility and good health of human beings is through the use of manure and other natural sources of organic matter as a source of plant nutrients in crop production. **It has been shown by scientific data that plants grown on mineral elements and fixed nitrogen alone have the characteristics of plants grown with the most satisfactorily developed compost.** Because of the fact that there is some question regarding the use of minerals and nitrogen in crop production as compared to the use of manure and other organic sources of plant nutrients, an investigation has been undertaken to ascertain information along this line.

A source of dry animal manure was obtained and a rather complete analysis made for the mineral and nitrogen constituents of this material. The analysis revealed (with some slight variation) that 4,000 pounds of dry manure contained 46 pounds of calcium, 12 pounds of magnesium, 74 of nitrogen, 6 of sulphur, 17 of phosphorus, 82 of patassium, 15 of iron, 6 of manganese, 0.14 of boron, 0.7 of copper and, of course, traces of molybdenum and other elements essential for plant growth. It was ascertained that the average manure was 80 per cent water and 20 per cent dry matter. Therefore, the usual ten-ton application of manure represented 4,000 pounds of dry matter.

(1) A paper presented before the American Chemical Society.

Greenhouse Tests

The first investigation in connection with mineral elements and nitrogen as soluble salts versus manure was carried out under carefully controlled greenhouse conditions using 10-gallon pots that held 150 pounds of soil. The elements found in manure were compounded by using various sources of inorganic salts such as to closely approximate the composition of manure in all elements. A Sassafras sandy loam was used in the investigation with average applications of fertilizer.

The experiment consisted of three treatments, each of which received the same amount of lime and fertilizer, namely lime to bring the soil pH value to approximate 6.2 and 5-10-10 fertilizer at the rate of 1000 pounds per acre. Using dry manure equivalent to 10 tons of wet manure per acre and the mineral elements and nitrogen equivalent to those found in the 10 tons of manure, seven crops were grown in the following order: tomatoes, alfalfa, tomatoes, Alaska peas, lima beans, carrots and tomatoes. The yields obtained from these crops are shown in Table I. In all instances, except with alfalfa and lima beans, an increase in yield was obtained from the use of manure and the mineral elements and nitrogen in manure. The second application of fertilizer and manure was made just after the growth of alfalfa. The lack of increase in yield from the manure and mineral elements was associated with those crops being capable of fixing their own nitrogen, namely alfalfa and lima beans. The data reveal that the mineral elements and fixed nitrogen in soluble form equivalent to the elements in manure produced superior yield in all cases other than the two afore-mentioned crops.

A careful analysis of the tomatoes and tomato vines was made and these data are shown in Table 2.

A number of soil conditions influence the chemical composition of the plant. For instance, if one factor such as nitrogen is limiting, the plants tend to accumulate elements such as calcium, magnesium, phosphorus, potassium and other elements. Therefore, **a mere analysis of a plant does not reveal actually what has happened, but it is obvious from the data on the per gram basis that the mineral elements and nitrogen are supplying these ele-**

Plants - Versus Manure

ments equal or superior to the manure. It is further revealed by these data that quality factors such as ascorbic acid, sugars, titrable acids, color, etc., of the tomatoes grown on the pots containing the mineral elements and nitrogen are equal to or superior to those grown without treatment.

Field Tests

Since mineral elements and nitrogen produced equally as good yields and quality as manure under controlled conditions, it was decided to investigate the same problem under field conditions. For this purpose a fertility-depleted Evesboro sand was used. The plants were so located that each treatment could be repeated for two consecutive years in the same spot. The results for 1948 are given in Table 3.

On the Evesboro sand 1/50th-acre plats replicated five times were planted with the Rutgers variety of tomatoes. The manure was applied previous to cultivation and the mineral and nitrogen salts equivalent to the manure were applied as a side-dressing while the plants were growing. It is obvious from the data shown in Table 3 that the manure was superior in yield and quality to no manure, but it is further observed that the mineral elements and nitrogen applied as a side-dressing were superior to manure. Twenty-five pound composite samples of tomatoes were taken at two

(Continued on page 75)

TABLE I
YIELD OF VARIOUS CROPS WITH MANURE AND SOLUBLE SALTS EQUIVALENT TO MANURE

	Grams Per 150 lbs. Soil Per Pot						
	Tomatoes	Alfalfa	Tomatoes	Alaska Peas	Lima Beans	Carrots	Tomatoes
Treatment (1)	G. Wt. Fruit	Dry Weight	G. Wt. Fruit	G. Wt. Peas	G. Wt. Beans	G. Wt. Roots	G. Wt. Fruit
No Manure	2424	130	247	27	178	650	839
Manure (2)	2635	93	793	43	90	650	1176
Mineral Elements & Nitrogen (3)	2815	129	911	53	165	665	1142

Original application made 8/24/45. Second application made 8/16/46.
(1) All pots received 100 lbs., 5-10-10 acre.
(2) 4000 lbs. dry cattle manure per acre or 10 tons wet.
(3) Minerals and nitrogen from soluble salts equivalent to manure.

TABLE II
COMPOSITION OF TOMATO VINES AND FRUITS

	m. e. per gram—dry weight					ppm—Dry Weight		ppm	m.e.—L.		
Treatment	Ca	Mg	K	P	N	Mn	Fe	Ascorbic Acid	G.-L. Sugar	Titrable Acids	Color
	Vines								Fruit		
No Manure	2.70	0.74	1.43	1.26	2.33	82	645	172	15.2	59	A—
Manure	2.31	0.72	1.46	0.15	1.21	102	625	173	26.0	52	B
Mineral Elements and Nitrogen	2.30	0.77	1.64	0.18	3.57	90	525	185	23.4	71	A

TABLE III
THE INFLUENCE OF MANURE AND CHEMICAL ELEMENTS IN MANURE UPON QUALITY OF TOMATOES UNDER FIELD CONDITIONS

				Grams per Liter			M. e. per Liter ppm						
Treatment	Relative Yield	Color (4)	pH	Total Solids	Ash	Sugar	Titrable Acids	N	P	Ca	Mg	Ascorbic Acid	Mn	Fe
No Manure (1)	55	C	4.55	58.7	4.55	30.5	58	124	12	3.0	1.9	229	0.3	4.3
Manure (2)	70	C	4.55	57.1	4.32	30.0	59	119	13	2.9	1.9	221	0.5	5.5
Mineral Elements and Nitrogen	100	B	4.55	61.0	4.98	34.7	64	135	14	2.9	2.0	219	0.5	5.5

(1) 1000 lbs. 5-10-10 per acre broadcast on all.
(2) 4000 lbs. dry cattle manure per acre equivalent to 10 tons wet.
(3) Elements in manure as soluble salts.
(4) Relative color—mean of two sampling dates, one early and one late.

Recent Farm Tours

Western Kentucky Green Pastures Tour

It's not so much how good or poor your soil, but rather how you use it that counts.

That was the main lesson in the Kentucky Green Pastures tour through Western Kentucky April 19.

Those who drove through the Pennyrile, the Purchase, and then back up the Ohio River Valley saw some outstanding examples of good pasture production and use. They also saw many more farms on which the soil was every bit as good, but they were producing only a fraction of the milk and meat.

In fact, on some of the farms which the tour visited it was possible to look across the fence rows and see ankle-deep grass on one side and washed-out brown lands heavy with broom sedge and bushes on the other.

Time after time tour leaders told of the way these farms had been built up.

Almost always the first step was a complete test of all the farm's land to find out exactly what it needed in the way of fertilizers and lime.

Then came the treatment program with those chemicals and finally the seeding of the kind of grasses and legumes that would grow well on that soil.

After that, is was just a matter of getting the livestock on those pastures and cutting the grasses and hay.

The H. H. Barlow farm in Barren County is an example. The soil in every field has been tested by the Barren County Soil Testing Laboratory. All of the 120 acres except two have been limed. Ammonium nitrate is applied to the winter pastures in March.

Since 1943, Barlow has spent $5,495 on lime and fertilizer.

His pasture mixtures are orchard grass and Ladino, fescue and Ladino, and some cross mixtures including brome, alfalfa and sweet and red clovers at times. His 21 acres of alfalfa are his major source of hay. Certified seeds are used exclusively.

Since 1931 his yields of corn and tobacco have been increased 300 per cent.

Or, look at the J. T. Rice farm in McCracken County. Rice started liming his farm in 1943 and finished in 1946. He started over again with three tons to the acre and has covered the farm at that rate, making five tons of lime an acre.

In 1948 he applied 300 pounds of superphosphate per acre on all the farm in addition to the T.V.A. treatments which have been made as each field became eligible.

In addition, 1,100 pounds of rock phosphate per acre was applied in September, 1946. Ammonium nitrate at the rate of 50 pounds an acre has been applied to the fescue land each spring since 1947.

The whole farm, except for his tobacco acreage, now is in fescue, some with Ladino and some with button clover.

On the G. B. Hays farm in Henderson County, the tour party got data on all 11 fields in the 243 acres, telling exactly the data and amount of fertilizers applied and the kind and time of seeding.

The Hays farm is in the heart of the corn-producing area and the folly of planting corn year after year on the hillsides instead of on bottom lands clearly was evident on some of the farms in that vicinity. Washing hillsides in some places were filling ditches and covering fences with topsoil.

SOUTH CAROLINA EXPERIMENT STATION TOUR

About 275 fertilizer manufacturers, dealers, salesmen, and others doing business in South Carolina, and agricultural workers and others concerned with crops and livestock production in this state attended the one-day tour of the Clemson Truck and Coast Experiment Stations near Charleston and Summerville, respectively, on May 16. They observed experiments affecting truck crops, beef cattle, and pastures under Coastal area conditions.

The keynote for the tour was given by Dr. R. F. Poole, president, Clemson College in an address during the noon hour when he pointed out the wisdom of learning more about the finer points of agriculture, especially as to the response of plants to fertilizers. He stated that the

—he used a fertilizer containing International Potash

Farmers don't *really* expect to get results like this. But they do find that the application of generous quantities of high-grade plant foods is a mighty big factor in producing large acre yields of finer quality grain.

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Spencer Chemical Company has completed the first month's operation of this, the world's largest prilling plant. Only one of the two 185-foot towers is in production. By August, with both towers, production is anticipated at 1,000 tons per day. The plant is at Pittsburg, Kansas, and part of the Jayhawk Works, a major ammonia unit of the Spencer organization.

fertilizer industry recognizes the wisdom of cover crops to be turned under to help keep a nutritional soil balance and to provide proper soil conditions for the growth and functioning of bacteria and fungi, all of which make for more efficient farming.

Other speakers at a short midday program following the Dutch chicken barbecue dinner at the Coast Station were—Dr. Russell Coleman, Washington, D. C., president, National Fertilizer Association; J. T. Lazar, Florence, district agent, Clemson Extension Service; Dr. H. P. Cooper, Clemson, director, South Carolina Experiment Station; and E. D. Kyzer, superintendent, Coast Station.

Dr. Coleman pointed to the need for more meat and to the fact that a good grassland farming-livestock program is being developed in the South and urged the continuation of this program to help provide meat for everybody. He urged members of the fertilizer industry to familiarize themselves with sound pasture fertilization practices so that when normal times come again they will be in a position to help prevent farmers from going back to "piny woods" pastures because of their failure to continue to fertilize their pastures. He said that properly fertilized pastures are now returning about 6 to 1 on the money invested but that, even should this ration drop to 2 to 1, buying fertilizers for pastures will still be a good investment.

Mr. Lazar said that great agricultural progress is being made in South Carolina due to the splendid teamwork of educational agencies, the fertilizer industry, and the farmers of the state. He called attention to the widespread interest in the spreading of fertilizers on pastures and suggested that this practice will likely be used for other crops. He expressed appreciation to the fertilizer industry for its cooperation in the promotion of the pasture and corn contests which are doing much to bring about better farming in the state.

Director Cooper stated that, while farmers have been fertilizing field crops for a long time, only in recent years has it become recognized that pastures really need more fertilizers in general than do their crops. He said that lime alone is not enough but that it is necessary to have a consistent and heavy fertilizer program for pastures and that they especially need potash. He cautioned that, unless farmers properly fertilize their pastures, they will soon have "piny woods" pastures again. This statement was given emphasis later in the afternoon when a properly fertilized pasture with plenty of potash was shown beside a plot where no fertilizer or potash had been used. The truthfulness of the statement was very evident from results to be noted in the comparison of the two pasture areas.

Mr. Kyzer told of the work being conducted on the 780-acre farm belonging to the station in pasture improvement and the cross breeding of Angus, Hereford, and Brahman breeds of beef cattle.

During the morning the group toured the Truck Station, where Dr. W. C. Barnes, station superintendent, and his staff explained the experiments in breeding, fertilization, insect and disease control, and other factors influencing yields, quality, and marketing characteristics affecting such crops as tomatoes, snap beans, Irish potatoes, melons, and other truck crops. Demonstrations showing very beneficial results from irrigation were also observed. A short visit was made to the USDA Southeastern Regional Vege-

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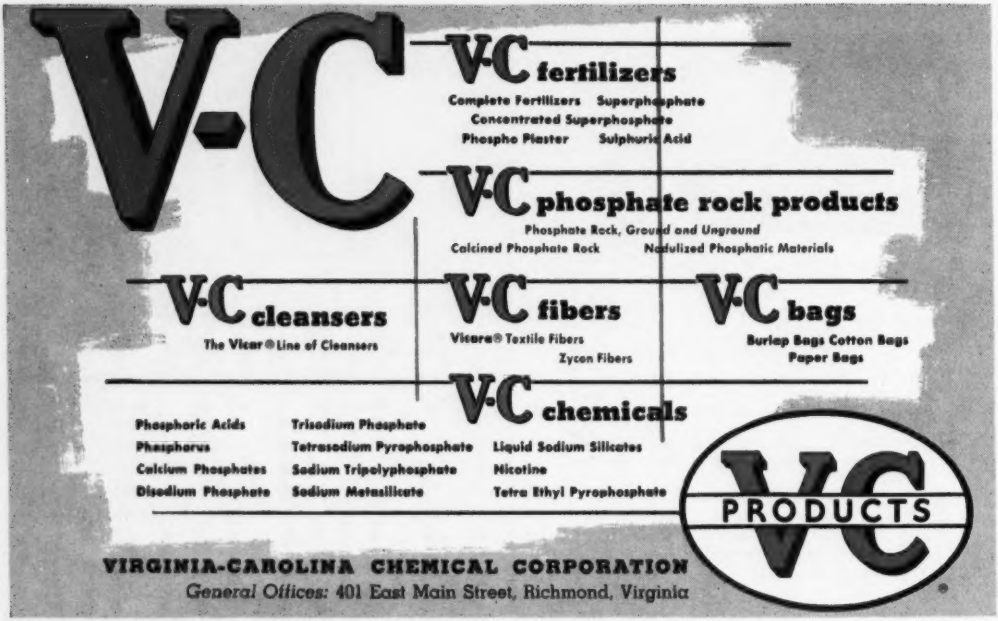

table Breeding Laboratory, where Dr. Sidney Yarnell and members of his staff explained breeding work being done with tomatoes, Lima beans, English peas, sweet corn, cabbage, watermelons, and other truck crops in an effort to find varieties adaptable to the Southeast.

During the afternoon tour of the Coast Station, the group had opportunity to observe summer pastures of Dallis grass and Ladino clover and winter pastures of fescue and Ladino clover and the good effects of the use of lime, phosphate, and potash as shown in the growth of both grasses and clovers. The experiments in cross breeding Angus, Hereford, and Brahman beef cattle were observed. The purpose of these experiments is to determine the birth and weaning weight, grade, and dressing percentage of the crossbred calves as compared with the purebred calves. Seventy-five purebred cows are being used in this experiment.

B. D. Cloaninger, head, Clemson Fertilizer Inspection and Analysis Department, arranged the tour and was ably assisted by members of the staffs of the two stations visited, by representatives of the Clemson Extension Service and of various other agricultural agencies and commercial organizations. Trucks for the tour were provided by nearby fertilizer companies or dealers.

Among out-of-state visitors on the tour and the organization with which each is connected were—Dr. Frank E. Boyd, Montgomery, Ala., V. C. Chemical Co.; Dallas Cantwell, Atlanta, Ga., Spencer Chemical Co.; Borden S. Chronister, Richmond, Va., The Barrett Division; Dr. Russell Coleman, Washington, National Fertilizer Association; H. G. Cunningham, Atlanta, Ga., Tennessee Corporation; Walton S. Dennis, Raleigh, N. C., International Mineral and Chemical Corporation; J. Merton Eggleston, Norfolk, Va., Robertson Chemical Corporation; Robert C. Fitzgerald, Wilmington, N. C., Smith-Douglas Co., Inc.; S. Gilson and S. T. Gilson, Thomson, Ga., International Fertilizer Co.; W. W. Harley, Savannah, Ga., Southern Fertilizer and Chemical Co.; M. E. Hunter, Richmond, Va., The Barrett Division; B. P. Johnson, Thomson, Ga., International Fertilizer Co.; H. B.

(Continued on page 75)

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Around the Map

ALABAMA

Peterman Agricultural Company, Peterman, is pretty proud of its modernization. "We have been operating with some very old machinery until this year" said President **P. S. Jackson** "and are very happy to have brand new machinery and equipment to work with." Production is running at about 200 daily tons, under the Black Diamond brand.

FLORIDA

Gulf Fertilizer Company and **Lyons Fertilizer Company,** Tampa, were among five firms recently presented ECA Awards. The Mayor made the presentation to **Fred Woods** of Gulf and **W. F. McLane** of Lyons.

• • •

The modern sewage disposal plant, Winter Haven, has completed a year of operation, and City manager **Cletus Allen** reports it turned out 35 tons of fertilizer, and will be the subject of articles in trade magazines soon. **Phil Seager** operates the plant.

GEORGIA

C. O. Smith Guano Co., Moultrie, are nearing completion of the rebuilding program which was inaugurated in December of 1950 to replace two fertilizer plants and a cotton warehouse destroyed by fire. The new plants will be considerably larger and have an annual capacity of approximately 100,000 tons.

ILLINOIS

Illinois Anhydrous Ammonia Co., Farmer City, expects to apply liquid ammonia to at least 16,000 acres this season, according to Plant Manager **Lloyd Lent.** The plant was recently opened, with 100,000 gallon storage capacity, and is already planning to double that.

MISSOURI

Bemis Bro. Bag Co., St. Louis, announces that the **Bemis Paper Bag Co.** plants at Wilmington, California and Vancouver, Washington became part of the parent organization on May 1. (See Washington)

• • •

Kilkenny Limestone Co. West Plains, has erected a new rock phosphate plant.

PENNSYLVANIA

Link-Belt Company has started construction of a plant for the production of elevating, conveying and processing machinery on a 43-acre site at Colmar. President **George P. Torrence** says it will be one of the most modern of its kind in the country, and will supplement the facilities of the plant at Philadelphia which was originally erected in 1888.

TEXAS

Phillips Chemical Company will start construction of a large sulfur extraction plant in West Texas, according to an announcement made May 18 by **K. S. Adams,** chairman, and **Paul Endacott,** president, of both Phillips Chemical Company and its parent, **Phillips Petroleum Company.**

This plant is designed to extract from natural gas nearly a quarter of a million pounds of elemental sulfur per day and will be located in the Permian Basin oil fields near Goldsmith. The output will be used by the company in connection with its ammonium fertilizer plant at Adams Terminal near Houston.

Sulfur is essential for vulcanization of rubber, for insecticides, for drugs, and for other important chemicals, as well as for the production of sulfuric acid used in commercial fertilizers, steel production, paper and newsprint, oil refining, and in practically all chemical manufacture. Limited reserves of elemental sulfur make it necessary that other sources be found.

• • •

Louisiana Liquid Fertilizer Co., of Bossier City, was the only bidder on the **Longhorn Ordnance Plant,** Karnack. They bid $5000 a year for the nitric acid section. No bids were made on the entire plant, nor the various other sections which the Government has offered for lease.

• • •

Hi-Yield Plant Food Co., Mt. Pleasant, will soon complete a new fertilizer plant with a capacity of 30,000 tons. This plant will manufacture fertilizers but not phosphates; will sell insecticides, feeds, and seeds; will do custom spreading with spreader trucks.

WASHINGTON

Bemis Bro. Bag Co., Seattle was badly damaged by an earthquake in April 1949. In rebuilding, the concern has provided additional,

badly needed floor space, and thus is able to offer better service in the Northwest. (See Missouri)

AUSTRALIA

Nairne Pyrites Ltd. has been organized at Adelaide by **Broken Hill Proprietary, Cresco, Wallaroo-Mt. Lyell** and **Adelaide Chemical.** They will acquire and explore five mineral claims in Nairne and South Australia.

* * *

Sulphur from lakes is the research project assigned the industrial chemists of the **Commonwealth Scientific and Industrial Research Organization.**

WEST INDIES

United Dye & Chemical Co., New York, will become the second US furfural producer when they put into production their new plant to utilize bagasse, the sugar-cane waste.

MEXICO

A large ammonium sulphate processing plant which has been under construction for two years in the town of Cuautitlan, a suburb of Mexico City, was officially inaugurated by President Miguel Aleman on May 21st.

This huge plant, financed by the National Financiera with funds provided by the Export-Import Bank of Washington, represents an initial investment of 80 million pesos, or more than 9 million dollars.

It is the largest plant of its kind in Latin America and will produce large amounts of fertilizer to revitalize Mexico's over-worked agricultural areas.

The plant uses gas brought from the Poza Rica oil fields through a special 125-mile pipe line. 1,000 cubic meters of gas are required to produce one ton of pure ammonia.

When finally completed, it is estimated that close to one hundred million pesos will have been invested in the project.

Mostly Personal

Ed Causey, manager of **Interstate Fertilizer Co.,** Cairo, Illinois, made a talk on fertilizer before the Rotary Club there, and called it "Your future's in the bag."

* * *

Dr. Ralph C. Tallman has been made director of research for **Lion Oil Company.** He replaces **Dr. Frank J. Soday** who has resigned to take the same post with **Chemstrand Corporation.** Dr. Tallman has been manager of the planning and survey department of Lion's research unit.

* * *

Patrick Dolan has been named district manager of the new office of the **Patterson Foundry & Machine Company,** which has been established at 1605 Court Square Building, Baltimore.

* * *

Fred J. Woods of **Gulf Fertilizer,** Tampa, Florida has completed three years as president of the Tampa Traffic Association, but remains on the board of directors.

* * *

Stanley F. Krzeszewski has been made a vice-president of **American Wheelabrator and Equipment Corp.,** Mishawaka, Indiana. He has been and will continue as factory manager.

* * *

Robert W. Suman has been made chief engineer of the Philadelphia **Link-Belt** plant, succeeding **William S. Campbell,** retired.

* * *

Virgil Givens, sales manager, **San Francisco Chemical Company,** Montpelier, Idaho, should now be addressed as follows: 5911 Walnut, Kansas City 2, Missouri—Phone Delmar 9513.

Brownlee O. Currey, who has been elected to the Board of Commercial Solvents, according to announcement by President J. Albert Woods. Mr Currey is an officer or director in a number of leading concerns.

* * *

Ray E. Neidig has been appointed to the office of vice president of **Balfour, Guthrie & Co., Limited,** of San Francisco, California.

* * *

Arthur Wilkinson has been appointed manager of the Chemical and Fertilizer Sales Department of the **Consolidated Mining and Smelting Company** of Canada, Limited, Montreal, succeeding **Robert Ruickbie** who has retired. **A. Olaf Wolff** has been appointed assistant manager of the department.

Bierly CFA Secretary

Sidney H. Bierly has succeeded Elmer S. Nelson as executive secretary of the California Fertilizer Association.

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Of all the sources of nitrogen, anhydrous ammonia is the most concentrated and the most economical. It is this preferred form that CSC produces at its Sterlington plant in Louisiana. Most of CSC's production is used to increase the value of productive crops from Gulf Coast soils.

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Fig. 2. Devices that are useful for measuring and estimating moisture tension in the field.

PLANT GROWTH RELATED TO FORCES THAT HOLD WATER IN THE SOIL

By Sterling A. Taylor, Utah AES

The growth and yields of agricultural crops depend on the moisture available during the growing season. Studies in recent years have shown that it requires work to remove water from the soil. The rate of growth of plants is related to the amount of work they must do to remove a unit amount of moisture from the soil. However, the relationship between the quantity of water in the soil and the growth rate of plants is indirect rather than direct.

At the Utah Agricultural Experiment Station research work is being done to establish some of the fundamental relationships between the amount of water in the soil, its movement, its availability to plants, and their response to moisture held in the soil by various forces. These studies will eventually lead to a knowledge that will permit a more efficient utilization of water to allow the maximum production with the limited water supply available in Utah.

Reprinted by permission from UTAH AES Bulletin: "Farm and Home Science", March '51.

Forces Holding Water in Soil are Important

The ease with which water in the vicinity of roots can enter the plant is related to the forces that are holding the water in the soil. More work is required to move a unit of water into the plant root if the forces holding it are large than if they are small. These forces are greater in soils that have many small particles such as clays, clay loams, and silty clay loams, than in soils with fewer particles such as sandy loams and sands.

It has long been known that the accumulative surface area of all the particles in a fine textured soil is greater than in a soil made up of coarser particles. This total particle surface affects markedly the movement and availability of moisture in the soil. Experiments have shown that more work is required to remove a unit of water from a soil containing a large particle surface than from one having a smaller particle surface even though both soils may contain the same percentage of water. Likewise it has been shown that if water is retained in these two soils such that the same amount of work is required to remove a unit of water, the soil with the greatest particle surface will contain a higher percentage of water (fig. 1).

Soil Moisture Stress Composed of Two Types of Forces

The force per unit area with which water is held in the soil

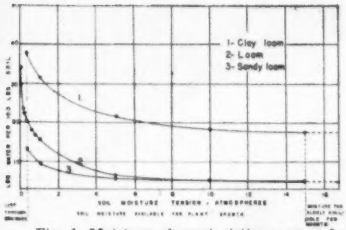

Fig. 1. Moisture characteristics curves for three common soils of the Western United States showing range of available and unavailable moisture. Curves 1 and 3 taken from R. Campbell.

is called soil moisture stress. Research workers at the U. S. Regional Salinity and Rubidoux Laboratories, Riverside, California, have shown that the total stress is made up of two types of forces, called soil moisture tension and osmotic pressure. The former is connected with the surface of contact between soil, water, and air. The latter depends directly upon the content of soluble materials in the soil, and is increasing importance in soils of progressively higher salt content. In soils of low salt content the osmotic pressure effect is small and moisture tension is responsible for the major part of soil moisture stress.

Available Range of Soil Moisture

Having free internal drainage, water applied to the surface of the soil will move rapidly into the drier soil beneath under the force of gravity, until the soil moisture tension reaches about one-third atmosphere (approximately five pounds per square inch pull on the soil moisture) after which the movement of water as a liquid is slow. Further drying out is attributable largely to evaporation and plant use. When soil is in this condition it is said to be in the range of field capacity. If drainage is impeded the moisture will move out of the soil slowly. Pore spaces will become filled with water and most plants suffer from insufficient ventilation (aeration) of the roots. After moisture in the soil has been removed by growing plants or by evaporation to a condition where the tension is near 15 atmospheres (approximately 220 pounds per square inch) growing plants can no longer extract water from the soil sufficiently fast to support growth and the plants wilt and remain so until more water is supplied from another source. These relationships are shown in fig. 1.

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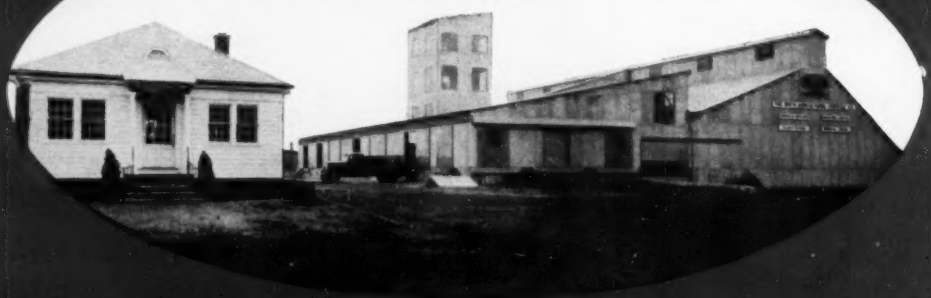

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plied it is desirable to apply sufficient to bring the soil moisture in the root zone of the growing crop to approximately field capacity. If more water is applied it will be lost in drainage, or it may cause a high water table or water logging. If less water is applied the plant will be under unnecessary stress to get the water and growth will be somewhat retarded.

The amount of water that any soil will hold at any given moisture tension depends upon the texture and structure of the soil. It can be seen from fig. 1 that a clay loam soil (curve 1) will hold about 18 pounds of water per 100 pounds of soil if the tension is near the permanent wilting point; it will hold about 38 pounds, if the tension is near field capacity, which means that 20 pounds of water per 100 pounds of soil is available to the growing plant. Hence if the soil moisture were near the wilting point, and if the dry soil weighs 75 pounds per cubic foot in its natural condition, and if the root zone extends to two feet, the maximum amount of water that can be used in the soil is 5.8 acre inches per acre. The irrigation water applied should not then exceed this amount. By the same reasoning it can be seen that a loam soil (curve 2, fig. 1) will hold about five pounds of water per 100 pounds of soil near permanent wilting and 21 pounds near field capacity with 16 pounds available to plant growth. Under the same conditions as above this means that an irrigation applying 4.6 inches of water would be maximum. A fine sandy loam soil (curve 3, fig. 1) will hold five pounds of water per 100 pounds of dry soil near permanent wilting and 14 pounds near field capacity with nine pounds being the available water-holding capacity. An irrigation of 2.6 acre inches per acre would then be appropriate for this soil if the same conditions prevailed as in the first soil.

Soils containing high salt have been found to hold more water at both field capacity and permanent wilting point, but the range of available water is gen-

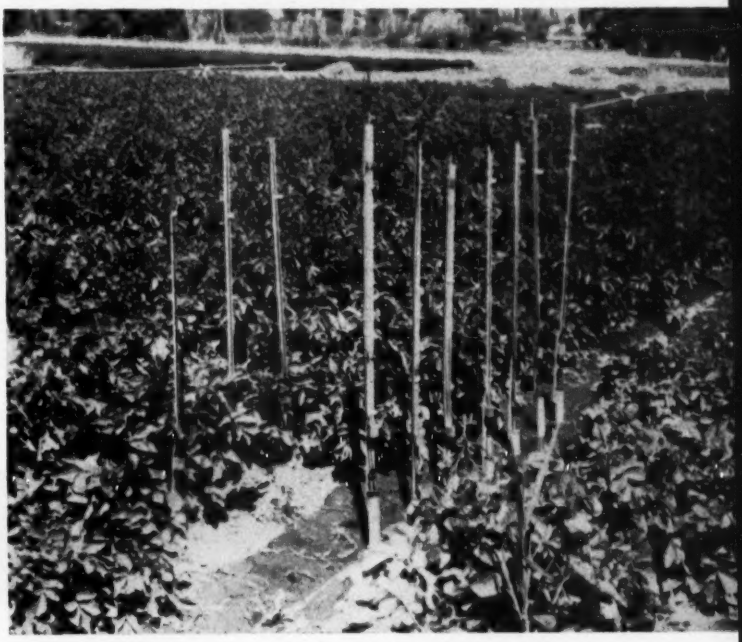


Fig. 4. Tensiometer being used to study the distribution of soil moisture from an irrigation furrow in a potato field. Picture courtesy Neil Heuser.

Fig. 3. Using tensiometers to study the movement of water into undisturbed cores of soil in the laboratory. Picture courtesy Neil Heuser.

erally smaller consequently saline soils will need more frequent but lighter irrigation than corresponding non-saline soils.

Plant Growth Better at Medium Low Moisture Tensions

In experiments conducted by the Utah Agricultural Experiment Station devices such as those shown in fig. 2 are now being used for measuring the soil moisture tension and availability of water to plants growing in the field. With the use of such devices it has been found that on the College Experiment Farm with soils of high fertility, best crop yields are obtained for alfalfa, sugar beets and potatoes, if the moisture tension is kept between one-third and about one or two atmospheres. On these treatments irrigation water is applied when the average moisture tension in the root zone reaches about one atmosphere and only sufficient water is applied to bring the soil in that zone to field capacity. This soil is represented by curve 2, fig. 1. The amount of water needed is often about one-half acre inch per acre at a single application, with irrigations occurring on potatoes and sugar beets about every two to five days during the summer. Larger but less frequent irrigations are required for established alfalfa because of its deep root system.

Forces Holding Water in Soil

If moisture tension is kept lower than this value excessive water may be present and conditions of poor aeration and water logging might reduce crop growth. This is particularly true if soils are not as well drained as those on the college farm. If tension is allowed to get much higher than this range plants wilt for part of the day and growth is retarded. The amount of retardation in growth increases as soil moisture tension increases until growth ceases entirely when the tension has reached about 15 atmospheres.

Moisture Tension Devices Used in Other Research

In addition to indicating when irrigation water should be applied and something about how much water should be applied at any one time, these tension devices are being used to show movement of moisture into and through the soil. Samples of undistrubed soil have been taken in the field and brought to the laboratory where water was applied to the surface. The movement of water in the core samples was studied by means of moisture indicating devices. The amount of water required to moisten the soil to various depths has been determined. The rate of entry of water into the soil and its speed of transmission have been measured. Observations have also been made on the amount of movement that occurs after the application has ceased. Studies of this kind are used to get basic information on the amount of water required by a soil at various stages of drying out. They also are useful in indicating how rapidly soils will take up water. This makes it possible to make more efficient use of water in the field. To be of most value these studies must be confirmed by carefully controlled field experiments. This is being done.

The use of tensiometers to study the movement of water from irrigation furrows is shown by fig. 4. These studies when used in conjunction with laboratory work will, when completed, provide the information necessary to determine such things as the rate water should be applied to a soil and the best spacing of irrigation furrows on different soils and for different crops. This will make it possible to keep soil moisture tensions in the desirable range for plant growth without excess water loss from run-off and deep percolation.

Diversity brings Success to ROWLAND & GORDON

By LURON BROWN

The Rowland & Gordon Company at Plainview, Texas, has geared its fertilizer and insecticide business to an empire.

The empire is the vast Panhandle Plains of the Lone Star State. A million acres of cotton will be under irrigation in this region in 1951. Much more will be farmed by dry land methods. In addition are the hundreds of thousands of acres of grain sorghums, wheat, corn, truck and permanent pasture.

As there is a minimum of acreage unfit for farming or permanent pasture, the Plains is almost one hundred per cent suitable for profitable fertilization. This fact and the great increase in irrigation inspired establishment of Rowland & Gordon Company four years ago.

Nerve and a shoestring launched the firm, first of its kind to appear in the shallow water irrigation belt of the High Plains. Virgil Rowland and Jason O. Gordon had an inexhaustible reservoir of nerve, but the shoestring was limited.

Virgil Rowland, left, and Jason O. Gordon, in the office of the Rowland & Gordon Co.

A workman is show applying the finishing touches to one of the Rowland & Gordon manufactured "Roundup" livestock sprayers in the firm's shop. This sprayer and the company's weed killer sprayer are made by Rowland & Gordon specifications and were especially designed for use by livestockmen in the Southwest. Started primarily to break a bottle-neck in merchandising their own stock in trade, the sprayer manufacturing operations are now an important revenue bearing part of the commercial fertilizer concern.

The partnership is a culmination of their association while students at Texas Technological College. Rowland is a native of New Mexico, Gordon of West Texas. As students of agriculture, they realized what irrigation and row cropping were doing for the originally fertile Plains. They talked commercial fertilizer and came to the conclusion that it was certain to have its inning.

But the proximity of the wolf to their doorsteps kept the planners out of business upon graduation from Texas Tech. Rowland went to work with the U. S. Bureau of Agriculture Economics. Gordon took a job as a Plains county agriculture agent.

Their commercial fertilizer venture rocked along in idea form for thirteen years. Then Rowland and Gordon staked all the cash they could scrape together on the business. It never occurred to the partners that they were pioneering in a country where pioneers are a dime a dozen.

The little spare time they had

could be better applied to worrying about selling commercial fertilizer to farmers who were growing crops on land that only a few years before was native sod.

It was in 1947 that they opened shop. Prices were high on every hand. Crops brought lots of money but it cost a small fortune to produce a crop on one of the Plains sections. But farmers bought fertilizer in the face of reasoning that they could make more money if they could grow more to the acre.

And Rowland & Gordon sold 1,000 tons of various fertilizers. They had to buy where they could find it, but they supplied the demand. Results were satisfactory from the farmers' viewpoint. In fact, they were so satisfactory that the next year the firm more than doubled its sales and did a great wholesale business.

Last year Rowland & Gordon sold 5,000 tons and 1951 promises to be by far their best year. Now the firm is doing business in a new building that affords 10,000 square feet of floor space. Their stock of fertilizers, insecticides, a sprayer manufacturing division and anhydrous ammonia storage are worth more than $200,000.

Rowland & Gordon opened one of the major business fields in this predominently agriculture country. Now there are several other large commercial fertilizer distributing concerns in Plainview. There is hardly a town of any size in all the Panhandle Plains that does not now have a similar firm.

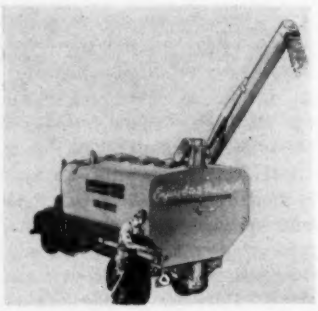
Anhydrous ammonia sales this year have boosted Rowland & Gordon business tremendously. Some of this product was used on wheat last spring but this fertilizer is really coming into its own this year.

From sixty to eighty pounds is recommended for cotton. Application is made either from 500 gallon tanks into irrigation water as it flows to the fields or by five tractor mounted John Blue units of equipment for injecting the fertilizer in liquid form six or eight inches below the surface of the soil in the preplanting treatment. When the crop is growing side dressings about four inches in depth are applied.

The application units can cover from sixty to seventy acres a day and are one-man operated. Rowland & Gordon do custom application of anhydrous ammonia.

Experiments last year with use of eighty pounds of anhydrous ammonia to an acre of cotton increased the yield 135 pounds of lint to the acre. The return for the fertilizer was approximately six dollars for one.

Ammonium nitrate is sold in large quantities for use on cotton, corn, grain sorghums and wheat. Lots of sulphate ammonia is used on truck crops. Irish potatoes, lettuce and onion crops have increased in the Plainview area in recent years.



Baughman Mfg. Co., Jerseyville, Illinois has just announced this bulk materials handling body which discharges as high as 16 feet above the ground, assuming a 39 inch truck frame, via screw conveyors. Write for details.

Rowland & Gordon has given special attention to use of commercial fertilizers to permanent pasture. Due to conditions peculiar to this area, the fertilizers are much more satisfactory than legumes in pasture mixtures. Eighty pounds of anhydrous ammonia or 150 pounds of ammonium nitrate, the latter applied to the surface, have proved very satisfactory.

Many livestockmen have plowed up permanent pastures after the legumes crowded the grasses out. Some legumes tend to bloat livestock when no dry feed is provided. For that reason permanent pastures with legumes predominating were getting a black eye until commercial fertilizers came to the rescue.

Rowland & Gordon point out that it takes legumes about three years to put an appreciable amount of nitrogen into the soil. In that length of time the legumes may have crowded out the grasses and depreciated greatly value of the pasture.

Application of the proper commercial fertilizers makes it unnecessary to plant legumes for nitrogen and in innumerable instances has solved a mean problem for livestock men.

It is a Rowland & Gordon policy never to oversell a customer. But they will go to great lengths to get a farmer to use enough the first time to provide proof of commercial fertilizer returns. Experience has taught

the dealers that if such procedure is followed the fertilizers sell themselves.

Hazards of over-selling, the partners have found, include adverse weather conditions and uncontrollable insect infestation. If a farmer goes overboard on fertilizers the first year he uses them and makes a crop failure, he may remember the cost of the fertilizer longer than he remembers the causes of the crop failure, although he stands a chance to more than get his money back from the fertilizer benefits on the next crop.

The Phillips Chemical Company supplies the stock of nitrogen fertilizers. The anhydrous ammonia is delivered to the storage plant in Rowland & Gordon's own 5,000 gallon capacity transport from Etter on the North Plains. Mixed products come from the Mathieson Chemical Corporation.

Rowland & Gordon do some blending of fertilizer mixtures. Users prefer pelletized preparations for several reasons and the firm so far has not deemed it good business to acquire equipment for pellet processing. Users like the pellets because they cause no dust, do not cake and are easily stored.

Until a year ago the company did a vast wholesale fertilizer business. The somewhat limited supplies of products has prompted them to concentrate on retail distribution.

Rowland & Gordon have discontinued custom application of dry fertilizers. Several factors entered into the move. It was too costly to maintain enough equipment and sufficient crews to meet the demands in the rush seasons. Inability to spread a farmer's fertilizer the day he wanted it might result in loss of a customer. Dependable labor was hard to get. The company resolved to quit the practice.

Now available for hire are sixteen ten-foot spreaders. Rowland & Gordon have found several kinds of spreaders satisfactory and now provide Baughman, Judson, Mt. Vernon and Gandy units for their customers. One unit can apply fertilizer to between 75 and 100 acres a day. Users pay 25 cents an acre.

Company pickups are kept busy delivering tanks of anhydrous ammonia, picking up empties, refilling them and returing the recepticles to banks

of irrigation ditches. The firm's personnel are subject to call at any time, day or night, to service the tanks, for irrigation ditches quit flowing only when the crop has been watered.

Rowland & Gordon has more than twenty kinds of insecticides registered with the Texas Department of Agriculture. They blend all kinds of powdered insecticides and operate an emulsifying plant in preparation of Toxaphene.

All kinds of insecticides used in the area are in stock. Airplane dusting companies handle Rowland & Gordon merchandise in poisoning insects and defoliating cotton. Last year there were five airplane dusting concerns working with Rowland & Gordon merchandise at one time.

The partners have found it builds their commercial fertilizer business and helps to make a sounder establishment to offer the extra products, services and equipment along with their major stock in trade, commercial fertilizers. Livestock and weed killer sprayer manufacture thus have their places in the business that started out solely as a fertilizer distribution concern.

The Broyhill Manufacturing Company builds a row crop sprayer to Rowland & Gordon specifications. The six-row unit sells for $187.50. Rowland & Gordon take great pride in the livestock sprayer which they designed and built in their own shop. The trailer type unit is sold complete with hose, nozzles and tires. The gasoline powered units are in four and six sizes for four and seven gallon pumps. Users like the fenders that protect their cars when the unit is being towed behind the family automobile.

The firm recently added a full time field representative to its personnel. He is Manuel W. Ayers, also a graduate of Texas Technological College, and a former Plains county agent. Ayers' services are free to any who call on him. Among his duties is that of acquainting farmers of advantages of anhydrous ammonia.

Rowland & Gordon give a free soil analysis service. The partners make it a point to keep abreast of commercial fertilizer development and experimentation. They are careful to disseminate any information they have. That is one way of building goodwill.

"We expect to be doing business at this same stand for a long time," is the firm's justification of the time they spend in free service.

STARTER

(Continued from page 41)

monly contained in the starter fertilizers, but also for attention to the sulfur, the calcium, and the magnesium unwittingly carried with, or inserted into, fertilizers as acid neutralizers or other contributors to the better storage and drillability of the goods. There is the call also for the trace elements in many instances, now that we are coming to look at crops as animal and human nutrition with more than bulk and caloric output as their values. Not only the trace elements needed by plants, but all of them known to be essential for plants, animals, and man, inclusive, must come to be considered in proper balance within the soil, if our nutrition is to be on a plane higher than that of the minimum and disaster, to say nothing of pushing it up to guarantee the optimum health of our livestock and ourselves.

Nutrient minerals and soil acidity foster sustaining fertility

The closer study of natural sustaining fertility has demonstrated soil acidity as a benefit more than a detriment. With the organic matter of our soils gone so low, we are realizing that the crop-yielding power of unfertilized soils, or what has been sustaining fertility, consists of that which is becoming available because the soil acidity is breaking down the silt mineral reserves. That isn't any speedy performance. It doesn't deliver enough to sustain much of a crop. It isn't bringing much along on the soil's assembly line for food output by the crop. Nevertheless, we can take advantage of the soil and root acidity acting on the soil's rock and mineral fragments as an acid treatment of them to give some sustaining fertility. That is just what Nature has been doing all these years. That is what the farmer has been using when he limes the soil. The soil acid treats the limestone and makes its calcium highly available. Instead of interpreting the liming for that service, we called it a method of "fighting soil acidity."

Those soils that do not have higher rainfalls to grow decayable organic matter generously and to produce lots of carbonic

acid from it, do not have so much, nor such speed, of that reaction. They haven't left in them many of the minerals that can be broken down. There we came on the geological scene too late from much in that respect to be left. Fortunately in the Midcontinent, the rivers flowing in from the drier West, especially the Missouri, bring flood-season supplies as river bottom land deposits. These are picked up by the wind during the rest of the year, and deposited at rates approaching a thousand pounds per acre annually after being carried northeastward long distances. This unweathered mineral, put on the acid soil for processing to give new fertility makes us appreciate the productivity of the "windblown" soils. The wind didn't make them fertile. It was this mineral reserve brought from the low-rainfall or unweathered area and processed by soil acidity under higher rainfall of the humid area.

On the other hand, there are soils that have had so much rainfall and are so warm during all the year that their minerals are weathered too far in this acid processing tratment. In the humid but more temperate zone, the weathering makes a clay that holds much acid, or hydrogen ions, and holds them firmly. But in the warmer, wetter soils, there results a clay that doesn't hold much acid. Southern soils go into that category and more so on becoming more tropical. "Our soils are not acid" you say, "in the South," apparently in consolation of escaping the need to fight soil acidity. But you miss some of the more effective soil acids' processing services that can give sustaining soil fertility from minerals, like limestone and rock phosphate, and can help to rebuild a soil.

High demand for protein calls for more sustaining fertility

That the clay fraction of the more acid soils is an effective reagent in the soil for decomposing the minerals there and for making their nutrient contents available to plants comes as a fact from the work by Dr. Ellis R. Graham at the Missouri Experiment Station. By using rock phosphate within a membrane suspended for six months in colloidal clay aliquots at different degrees of acidity (pH values) he could measure the phosphorus mobilized into the clay by its acid. With the ratio of two parts of rock to one

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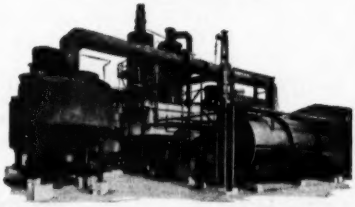

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of an acid clay, pH 4.7, a quarter percent of the phosphorus was made available. With a more acid clay, pH 3.5, that is with it completely saturated by acidity or hydrogen, two percent of the phosphorus in the rock was broken out. Other minerals demonstrated their decomposition under similar treatment to point out that reserve minerals in an acid soil can be the sustaining fertility, and in a larger way according as the soil depth for more root contact is greater.

Starter fertilizers put no deeper than only the shallow surface layer of a profile, which is not increasingly fertile with greater depth, means pushing the crop off to a good start for much vegetative growth. But it means also the failure by it to find enough fertility as the roots go deeper to carry the plant through on that level for high seed yield with high concentration of protein in it. Kansas wheat makes higher protein grain as the roots find extra nitrate nitrogen at greater depths in the soil. Experiments at Missouri showed that early spring applications of nitrogen on the wheat increased the yields of bushels per acre. But it was its application later in the growing season that increased the concentration of protein in the grain. Such results tell us that the starter-fertilizer nitrogen in the surface soil was only starter protein. It was responsible for larger yields of wheat per acre. But it was only the sustaining fertility nitrogen down deeper in the soil that could put the higher concentration of protein into the final harvest.

It is about time to rethink some of our concepts about fertilizers now that chemical nitrogen is telling us that as fixers of nitrogen the legume crops were not giving us all the extra nitrogen in the soil needed for growing the bigger crops while maintaining its nitrogen supply. Evidently legumes were not fixing nitrogen significantly on soils where so many of the other elements—including the trace elements—besides nitrogen, phosphorus and potassium were not given attention for their help in the better functions by legumes as gatherers of nitrogen from the atmosphere. Now with the added inorganic nitrogen under favorable economic settings correcting the present major fertility deficiency, higher crop yields than ever are exhausting all the other fertility elements from the soil more speedily.

Food security demands more fertilizers on more soils

All this is telling us that starter fertilizers applied at rates per acre that once were common are not even enough for that function which ceases to be served when the surface soil dries. It ceases when the roots must find their sustaning fertility deeper in the soil where they must go to get also the extra water needed to guarantee their larger yields.

Sustaining fertility is a new demand for more fertilizers now that we appreciate more fully the decline in natural fertility and the threatening exhaustion of that supply. It is a new market when larger acre-yields are given larger margin of profit on the input into crop production. While the higher nutritional quality is being brought into the larger yields also, this will call for the balance of the soil treatments more accurately according to soil and plant tissue tests. Nevertheless, it brings about a more efficient use of fertilizers and more economical returns on all the items listed on the cost sheet.

More fertilizers will be de-

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manded for some time ahead as the conditions assembled to form the rising curve of recent past amounts used indicate. At the same time the returns from them will be on a sounder basis when all of the different materials on the market are used most effectively both as the starter fertilizers and as the sustaining fertility. Such judicious procedures will not only build up bigger and more nutritious crop yields, but will also build up the soil by building the fertility deeper down into it. They will put more security for all of us into more of our soil.

MANURE

(Continued from page 53)

different periods during the harvest season for analysis and the mean of the results is given in Table 3. In other words, in order to offset the difference in data of maturity, the two sets of samples were taken.

The 1949 crop grown on the identical plats shows the same characteristics. From these data therefore it can be safely said that if the mineral elements and nitrogen are supplied to the plant at the proper stages of growth, an equivalent growth and quality of the crop can be obtained as compared with that from the average use of manure. It is therefore the opinion of the author that through the proper use of mineral elements and nitrogen to attain the optimum nutritional balance for the crop concerned, maximum yields and quality may be obtained.

TOURS

(Continued from page 58)

Mann, Washington, D. C., American Potash Institute, Inc.; J. C. Morcock, Atlanta, Ga., The Barrett Division; Frank Mikell, Statesboro, Ga., Armour Fertilizer Works; J. T. Murray, Savannah, Ga., Mutual Fertilizer Co.; J. A. Naftel, Auburn, Ala., Pacific Coast Borax Co.; William Perry, Sardis, Ga., Armour Fertilizer Works; Dr. J. Fielding Reed, Atlanta, Ga., American Potash Institute, Inc.; E. F. Savage, Griffin, Ga., Georgia Experiment Station; O. H. Stanard, Raleigh, N. C., American Limestone Co., Knoxville, Tenn.; C. H. Stanton, Wilmington, N. C., Swift and Co.; L. G. Walton, Wilmington, N. C., T. W. Wood and Sons; Roy Williams, Elm City, N. C., Farmers Cotton Oil Co., Wilson, N. C.; Albert Woods, Raleigh, N. C., Potash Co. of America, Inc.; L. N. Cook, Savannah, Ga., Southern Fertilizer and Chemical Co.; B. W. Davis, Savannah, Ga., Southern Fertilizer and Chemical Co.; John L. Cope, Savannah, Ga., Reliance Fertilizer Co.; J. L. French, Richmond, Va., V. C. Chemical Co.; and Dr. S. F. Thornton, Norfolk, Va., F. S. Royster Guano Co.

NORTH CAROLINA SMALL GRAIN TOUR

"The best small grain crop in recent years" was the unanimous verdict of some 140 fertilizer representatives, seedsmen and others who made a tour of small grain fields in Johnston and Wake Counties, North Carolina, on May 22. The tour was sponsored by the Agronomy Department of N. C. State College.

The new varieties of small grain—Atlas wheat and Arlington oats — won special acclaim from the tourists. One sidelight of the tour was a contest to see who could come closest in estimating the yields of several fields visited. Some of the estimates were as high as 110 bushels per acre for oats and 55 bush-

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els per acre for wheat.

The tour began at the McCullers Experiment Station 12 miles south of Raleigh. W. E. Colwell, head of the Agronomy Department, told the visitors that average small grain yields in North Carolina are only about half what they should be. The State average for oats is only 30 bushels per acre, while the average for wheat is only about 15. "Many of the fields you see on this tour will yield well over 60 bushels of oats or 30 bushels of wheat," he said.

Colwell also pointed out that a small grain-soybean rotation is showing considerable promise in central and eastern parts of the State. He emphasized, however that this double-cropping plan called for "time-clock" operations to get the soybeans harvested and small grain planted in the fall and the small grain harvested and soybeans planted in the spring.

F. J. Bell, seed and small grain specialist for the N. C. State College Agricultural Extension Service, who was in charge of the tour, discussed results of fertilization on small grain. In one test, he said, wheat which received no fertilizer or top-dressing yielded 17 bushels per acre; wheat fertilized at planting but not top-dressed yielded 20 bushels per acre; wheat top-dressed but not fertilized at planting produced 26 bushels per acre; and wheat which received both fertilizer at planting and top-dressing produced 36 bushels per acre.

The Dwight Rolland farm near Willow Springs was the first stop after leaving McCullers. Rolland, who uses small grain in rotation with tobacco, showed the visitors outstanding fields of both oats and wheat.

Other stops were made at the Sherman Yeargan farm near Garner and the Yeargan Brothers Farm near Clayton. Outstanding fields of Arlington oats and Atlas wheat were seen at these locations.

The tour attracted visitors from throughout North Carolina and from as far away as Hartsville, S. C.

PACIFIC NORTHWEST FERTILIZER CONFERENCE

The 2nd Annual Pacific Northwest Fertilizer Conference will be held June 28th and 29th at Oregon State College, Corvallis, Oregon. Sponsored by the newly formed Pacific Northwest Plant Food Association through its Soil Improvement Committee, this meeting will feature soils and fertilizer specialists from colleges, experiment stations, the U. S. Department of Agriculture and industry in the three northwest states. One of the featured speakers will be Dr. Frank W. Parker, Assistant Chief, Division of Soils, Fertilizers, and Agricultural Engineering U.S.D.A. Beltsville, Maryland. Dr. S. C. Vandecaveye, President of the Soil Science Society of America and a soil scientist at Washington State College will also be a speaker.

These fertilizer conferences originated at Puyallup, Washington, in 1950 for the purpose of disseminating the latest soil and fertilizer research information to the fertilizer industry and the agricultural public. The meetings are open to all. It is expected that fertilizer dealers, soil fertility specialists and field men concerned with soil fertility problems will swell the attendance to well over 500. While attendance will be largely from Oregon, Washington and Idaho, good representation is expected also from British Columbia, Alberta, Montana and Utah.

Starting at 8 a.m. on June 28th, the discussions will cover the fertility problems for vegetables and small fruits, forage crops, wheat, and sugar beets. Also included are talks on the latest developments in fertilizer placement machinery and a trip to the field trials of the Oregon State College Soils Department. While chief emphasis will be on Western Washington and Oregon conditions, problems of the irrigated and dryland farming areas of the three states will be discussed. Program chairman

for the conference is Dr. R. A. Pendleton, stationed at the Soils Department of Oregon State College. He is a Soil scientist of the U. S. Department of Agriculture and is also a member of the Soil Improvement Committee of the Pacific Northwest Plant Food Association.

In a pre-conference meeting on June 27th, soil and plant analysis specialists will meet for discussions on methods of analysis and interpretations. College and commercial laboratory chemists will speak on the latest developments in their soil and plant testing programs. A special question-answer session is scheduled for the afternoon to stimulate discussion and exchange of ideas on this very important aspect of the soil fertility program. This meeting is called "pre-conference" because it will be of benefit chiefly to those trained in the technical phases of soil and plant analysis, but attendance is not restricted.

PROGRAM

Thursday, June 28, 1951
Morning

Chairman: R. A. PENDLETON, Soil Scientist, Oregon State College.

8:00-8:30—Registration—Memorial Union Building, Oregon State College, Corvallis, Oregon.

8:30-8:45—Welcome—F. E. PRICE, Dean of School of Agriculture, Oregon State College.

8:45-9:00—Response—G. A. FITZPATRICK, President, Pacific Northwest Plant Food Association; Manager, Chemicals Division, Pacific Supply Cooperative, Portland, Oregon.

9:00-10:15—Soil Fertility and Plant Nutrition, Some General Views.

"N-P-K"

L. C. WHEETING, Research Professor in Soils, Washington State College, Pullman, Washington.

"Sweet or Sour"—The influence

(Continued on page 81)

OBITUARIES

Harvey W. Clements, manager of the Chicago general sales division of Bemis Bro. Bag Co. since 1930, and with them since 1912, died April 11 at Chicago.

David Henry Rainwater, 71, an employee in Atlanta of the Tennessee Corporation, May 16.

Oplis Sloan, 43, of Knoxville Fertilizer Company, May 4.

Henry London Taylor, 62, assistant sales manager of chemical sales for Lion Oil Company, died May 23 at Lumberton, North Carolina, after a brief illness.

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MANAGEMENT INSTITUTE ISSUES PERSONNEL CHECK LIST

A checklist of 27 points for evaluating the personnel practices of business companies has been prepared by the American Institute of Management, New York, based on its continuing analysis of the methods employed by the 243 corporations which it considers to be "excellently managed." The list has been made public by the Institute as suggested standards to be applied by top-management in stepping up the efficiency in personnel recruitment, training, executive development and other personnel department activities.

The Institute's checklist includes the following questions:

1. Does the personnel manager operate in a staff capacity?

2. Does the personnel manager report directly to the chief executive or an officer having company-wide responsibility?

3. Does the personnel department implement company policies through continuous advisory consulation?

4. Are the rank, status, responsibility, authority and salary of the personnel manager comparable to other officers in the organization?

5. Are the personnel manager's status, responsibility and authority defined and in writing?

6. Does the personnel manager recognize that policy planning is his primary function?

7. Have the line and staff phases of personnel administration been made clear to all executives, department heads and supervisors.

8. Are supervisors primarily responsible for the directing and development of their personnel?

9. Does the personnel department disallow attempted shifts of administrative responsibility with respect to departmental personnel problems?

10. Does the personnel department play only an advisory part in determining changes in individual rate and salary payments?

11. Is the counsel of the personnel department sought in determing and planning lines of promotion and in selecting people for promotion?

12. When the personnel director is called on to perform a line function, is it always made clear in writing that this is an extra-curricular function?

13. Do representatives of the personnel department participate in conferences of professional personnel groups?

14. Does the personnel department maintain an attitude of objectivity in relation to management, workers and community?

15. Is the personnel department well advised on current labor policies, legislation, development in the field of industrial relations, and reading matter?

16. Does the personnel department consider that in at least some instances the reliability of merit rating and testing is of debatable value?

17. Has a written plan of objectives, action and timing been formulated with regard to company-wide personnel activities?

18. Has the formal personnel program of the company been tailored within the last year to meet changing company needs?

19. Has the personnel department constructed job evaluations and developed rating devices for use by the line organizations?

20. Are all company policies reduced to written, published statements?

21. Is the chief executive of the company personnel minded?

22. Does the personnel manager constantly strive to make the management appreciate the need of changing its thinking and acting for harmonization with the personnel program?

23. Does the company carry on executive development activities?

24. Are all company policies, as they affect the personnel function, in keeping with the times, fair within the industry and based on moral truth?

25. Does the personnel manager have clearly defined and in writing the delegation of re-

Mixed Fertilizer Sales Subject to CPR-22

The Office of Price Stabilization officially ruled May 29 that sales of mixed fertilizer by a manufacturer to a farmer **are not sales at retail** as defined in Section 47 and clarified in Interpretation 15 of CPR-22. They are commercial sales.

sponsibility and authority of the people under him?

26. Are the principles advocated by the personnel manager followed in the supervision of the personnel department?

27. Are the following activities included in the personnel function?

(a) Assisting in the fostering of satisfactory employer-employee relations.

(b) Insuring coordination of personnel activities throughout the entire company.

(c) Obtaining, maintaining and fostering the development of the entire company workforce.

(d) Fostering the utilization of the workforce in the most efficient manner from an employer-employee viewpoint.

The American Institute of Management is a non-profit foundation for the study of management problems and the auditing of corporate managements. Headquarters of the Institute are at 50 Washington Mews, New York 3, N. Y.

In the Field of ALLIED FARM CHEMICALS

Dilan, a nitroparaffin-derived insecticide base by **Commercial Solvents Corp.** has USDA label approval for use on Mexican bean beetles and potato leafhoppers. Production to date is small.

• • •

Lindane, for livestock pests is made in five formulations backed by **California Spray Chemical,** sold under the Ortho label.

• • •

Aramite, a miticide developed by US Rubber's **Naugatuck Chemical,** is non-toxic to humans or animals, and is the only such chemical now available.

• • •

Zineb, a powered form of dithane and parzate is proving itself as a fungicide in Florida, to control blight on potatoes and tomatoes. The Sub-Tropical AES has a good report on it.

• • •

Sulphenone, a pesticide by **Stauffer,** has been approved for certain orchard crops by USDA and is being sold as a 40% wettable powder, to control mites in almonds, apples, d'Anjou and Bartlett pears.

Newton Solved it!

The New York AES has a bulletin headed "Why Plums Drop to the Ground." We were sure that Isaac Newton answered this question, until we learned that it had to do with, not why the drop, but why they turn loose from the tree. If you want to know the answer to that, ask NY AES at Geneva, N. Y.

Benzene hexachloride and DDT are now both in production at the **Kolker Chemical** plant at Houston, Texas.

• • •

Allethrin is to be produced in Baltimore by **U. S. Industrial Chemicals** when the plant planned is completed in 1952.

• • • •

Surfactants is the name chosen by **Antara Products Division** of General Dyestuff Corp. for the surface active ingredient they make for insecticides and herbicides. They have produced a manual designed to help compounders make selections of the correct agents, which you can get free by writing Department 53, 435 Hudson St, New Yourk 14.

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BOOKS

FUNDAMENTALS OF HORTICULTURE, by J. B. Edmond, Ph.D.; A. M. Musser, B.S.; and F. S. Andrews, Ph.D. Published by The Blakiston Company, Philadelphia 5, New York 22, Toronto 2. Price $5.50.

This is a Why book, with emphasis on fundamentals instead of on specific operations. The authors have divided it into three parts—One, a working knowledge of the fundamentals of plant growth. Two, application of this knowledge to the solution of plant production problems. Three, discusses the characteristics, economic importance, distribution and growth of fruits, vegetables and ornamentals.

The book has 30 tables, 149 illustrations, 502 pages and was designed as a text for a semester or quarter course in general horticulture. It will make a valuable reference work for addition to the library of any fertilizer manufacturer or agronomist to whom horticulture is important.

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BIBLIOGRAPHY OF REFERENCES TO THE LITERATURE ON MINOR ELEMENTS, Fourth Edition, Volume II, published by Chilean Nitrate Educational Bureau, 120 Broadway, New York 5.

Volume 1 of the Fourth Edition was published June 30, 1947, as reported here at the time and included 10,000 abstracts covering 206 crops, 45 elements, 4,463 authors. Volume II contains 1,222 abstracts from scientific journals published between July 1947 to December 1950. It includes 141 crops, 45 elements, 1300 authors and co-authors. Complete indeces are provided.

EFFECTIVENESS OF GRAVITY DRAINS AND EXPERIMENTAL PUMPING FOR DRAINAGE; DELTA AREA, UTAH, by O. W. Israelsen, D. F. Peterson, Jr., R. C. Reeve. Utah AES, Utah State Agricultural College, Logan, Utah. Bulletin 345.

Normally this does not belong under book reviews, but so complete and thorough has been the report rendered by this AES, we felt many agronomists and fertilizer manufacturers troubled with land-drainage problems would find it a valuable reference work.

YOUR LAWN by Geoffrey Cornish, University of Massachusetts, with illustrations by Carol Burr Gawthorp. Published by Authentic Publishing Co., Inc., 145 W. 57th St. New York 19, but on sale at newsstands throughout the country; price 50¢.

This work deals with the maintenance of established lawns and the construction of new ones, by a man who gained his knowledge via the practical route of construction and maintenance of golf courses in the US, Canada and West Indies.

DuPont Dedicates $30,000,000 Research Lab

Du Pont's new Experimental Station addition—a $30,000,000 investment in research as a way to economic progress—was dedicated May 10 in Wilmington, Delaware before an assembly of some 200 distinguished academic and industrial scientists.

Nineteen buildings were constructed in the expansion program, including nine laboratory buildings, one of which is located in the older area, and 10 service buildings. Two of the laboratory buildings in the older area were substantially enlarged as part of the project.

The Station now has about 800 technically-trained research workers representing a wide range of sciences. In addition, it has approximately 1500 non-technical employees. The technical employees include graduates of more than 200 colleges and universities and 575 of these employees hold advanced degrees.

The Du Pont Company in 1950 spent $38,000,000, exclusive of construction costs, to support its research activities.

New Payloader Catalog

The Frank G. Hough Co. has just released a catalog entitled "Model HA Payloader—a fast, compact, bulk material handling unit." It pictures and describes the improved 12 cu. ft. Payloader tractor-shovel and also carries almost two dozen application photos showing some of the many kinds of jobs and industries where this machine is saving time, manpower and money. Copies of this new catalog can be secured by writing The Frank G. Hough Co., 702 Seventh St., Libertyville, Illinois, or from your Hough distributor.

Fertilizer Guaranties Met 88 Per Cent

Eighty-eight per cent of the guaranties of all fertilizer materials officially analyzed by the Department of Analytical Chemistry of The Connecticut Agricultural Experiment Station during 1950 were met by their manufacturers. This information is contained in the most recent annual report on commercial fertilizers, just published by the Station.

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PROGRAM

(Continued from page 77)

of soil acidity or alkalinity on plant nutrition. B. R. BERTRAMSON, Head, Department of Agronomy, Washington State College, Pullman, Washington.

"Minor Elements" — Their importance in northwest agriculture. A. W. MARSH, Associate Soil Scientist, Oregon State College.

10:15-10:25—RECESS

10:25-10:50 — A field-man's Viewpoint on Growers' Soil and Soil Fertility Problems. JOHN JOHNSON, Head, Field Department, Blue Lake Packers, Salem, Oregon.

10:50-11:15—A Glance at the Fertilizer Research Programs of the Food Processing Industry. WALT NEWBERG, Birdseye Division, Birdseye Snider, Hillsboro, Oregon.

11:15-11:40—Fertilizer Studies with Vegetable Crops by Oregon State College. S. B. APPLE, Associate Horticulturist, Oregon State College.

11:40-12:15—Orchard Fertilization, R. E. STEPHENSON, Soil Scientist, Oregon State College.

12:15—LUNCH

Afternoon

1:30-4:30—Tour of Experimental Area, Oregon State College.

6:30—Banquet, Hotel Benton, S. C. VANDECAVEYE, President, Soil Science Society of America, Guest speaker.

Friday, June 29, 1951

Morning

Chairman: J. L. WURSTEN, Simplot Soil Builders, Idaho Falls, Idaho.

8:35-9:00 — The Grassland Program, Its Place in Northwest Agriculture, H. A. SCHOTH, Agronomist, U. S. Department of Agriculture, Corvallis.

9:00-9:25 — Fertilizer Demonstrations with Forage Crops in Oregon, A. S. KING, Extension Soil Conservation Specialist, Oregon State College.

9:25-9:50—Fertilizing Forage and Pasture Crops in Washington, F. T. TREMBLAY, Soils Scientist, Western Washington Experiment Station, Puyallup.

9:50-10:00—RECESS

10:00-10:55—Nitrogen Fertilization of Wheat in Non-irrigated Areas.

Oregon—M. M. OVESON, Superintendent, Pendleton Branch Experiment Station, Pendleton Oregon.

Washington — T. L. JACKSON, Agronomist, Washington State College, Pullman.

Idaho—G. O. BAKER, Soils Scientist, University of Idaho, Moscow.

10:55-11:20—Fertility Problems of Sugar Beets and Related Crops, R. A. PENDLETON, Soil Scientist, Oregon State College.

11:20-11:45 — Oregon's Fertilizer Program for Sugar Beets and Corn, A. S. HUNTER, Soil Scientist, Oregon State College.

11:45-12:10 — Foliar Analysis of Sugar Beets, F. S. FULIMER, American Potash Institute, Los Angeles, California.

LUNCHEON

New England's Green Pasture Program, M. H. McVICKAR, The National Fertilizer Association.

1:30-2:00 — The USDA Grassland Program, KNOX HUTCHINSON, Assistant Secretary of Agriculture, Washington, D. C.

2:00-2:25—The "Why" of Fertilizer Placement and Experimental Placement Machinery. K. E. BAUR, Pacific Supply Cooperative, Portland.

2:25-3:00 — Fertilizer Distributing Machinery, C. E. GUELLE, Seeding Machine Sales, International Harvester Company, Chicago, Illinois.

3:00—Report of Soil Improvement Committee, G. A. WICKSTROM, Field Agronomist, American Potash Institute, Sumner, Washington.

Closing Remarks — G. A. FITZPATRICK, President, Pacific Northwest Plant Food Association.

CLASSIFIED ADVERTISING

For Sale, Exchange and Wanted Advertisements, same type now used, EIGHT CENTS a word for one insertion; TWELVE CENTS a word for two insertions; FIFTEEN CENTS a word for three insertions, and FOUR CENTS a word for each insertion more than three; ADVERTISEMENTS FOR THIS COLUMN MUST BE PAID IN ADVANCE.

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